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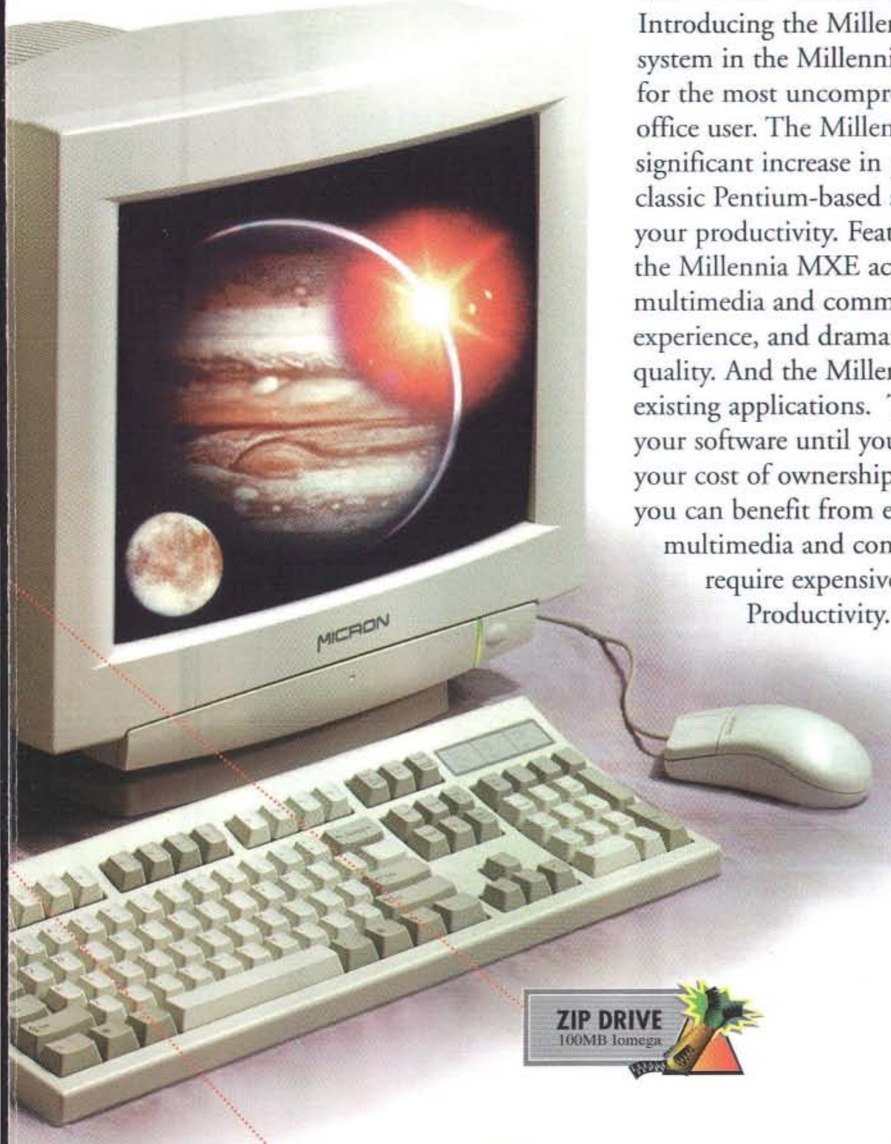

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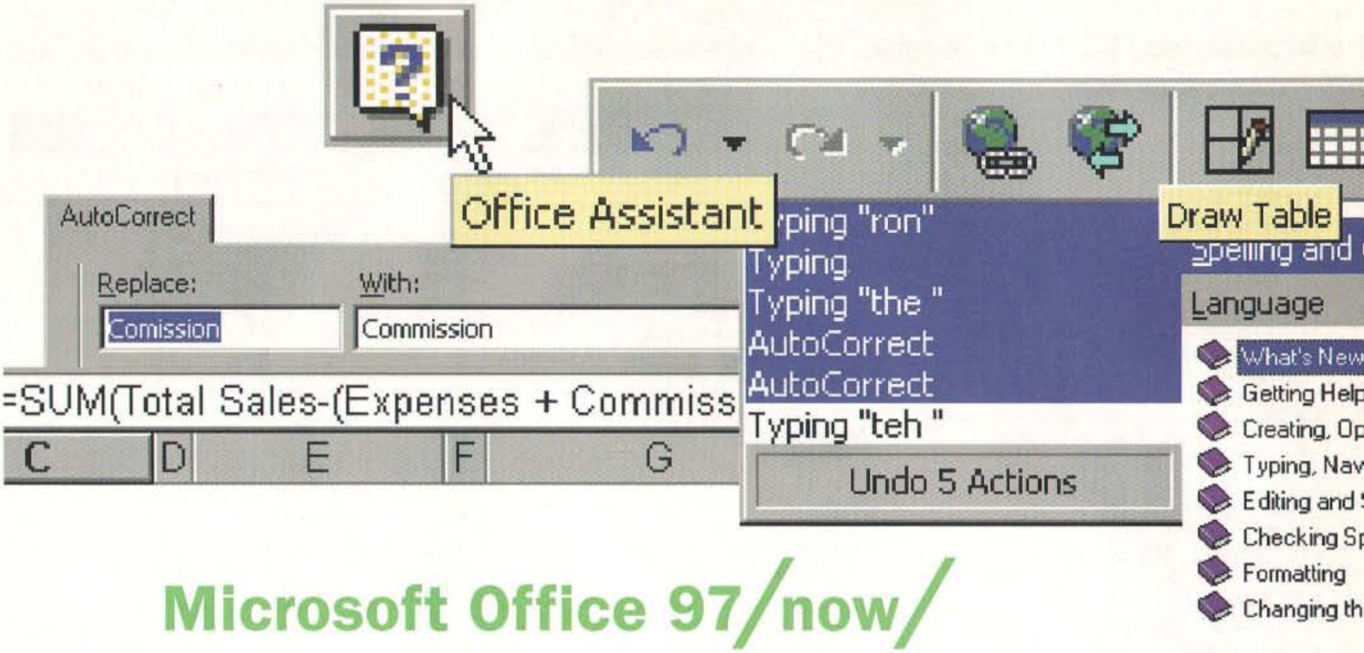

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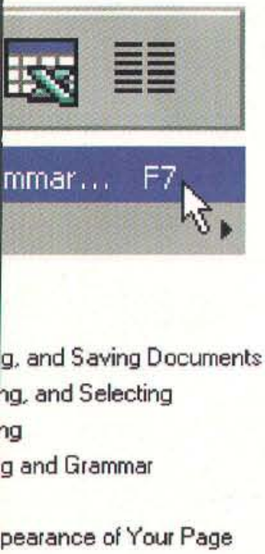

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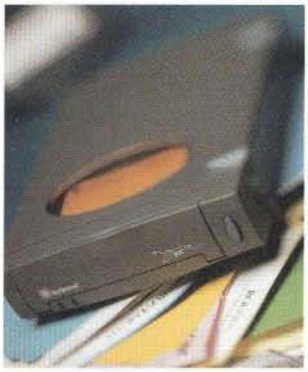

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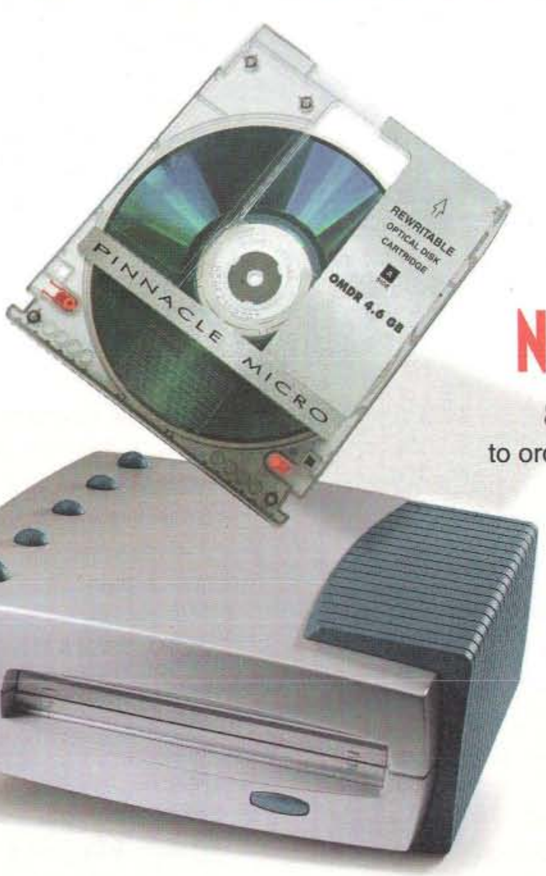

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BYTE

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editorial

Apple's Opening Move

If the company's desperation gambit works, users will gain a strong content/applications-development combo.

This month's cover story focuses on Netscape's technology plans for transforming the Internet into a serious business platform. Very few companies in the history of computing have become platform companies, and fewer still have done it by themselves. Arguably, only IBM—in the System 360 days—has successfully pulled off that feat.

The more successful approach has been to leverage others' innovations and standards. That means not being seduced by lock-in, the idea that a vendor can guarantee you as a customer by making it impossible for you to go elsewhere. You'll always find a way to get the best value, because it's your money and your job. Right now, Netscape is walking the line between having unique technology and being too proprietary; our story suggests that it's leaning toward openness.

Perhaps Netscape has learned from Apple's negative example. I'm one of those who believe that if Apple had opened up its architecture with the first Macintosh, the history of computing would be different. While Apple has since opened up in some important ways—by adopting TCP/IP and the PCI bus, for example—it has still remained largely its own island of technology.

Next was forced out of that posture by its failure as a hardware vendor. Now Apple has finally recognized its limits and found, in Next, a partner that's proven it can deliver a contemporary OS.

Sure, it was a desperation move, and if they can't deliver on time, they're cooked. But it was the right thing—maybe the only thing—to do, short of porting the whole project to Intel and becoming a software company. Or having a fire sale.

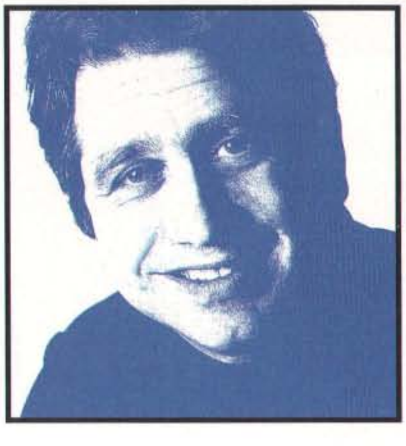
Good for Apple. But should users wax Rhapsodic over the future of the Mac OS? With a features checklist that's competitive with those of Windows NT and Unix, an industrial-strength development environment, and enterprise-worthy system hooks, will Next finally answer Apple's corporate critics and open the door to MacBusiness?

The most obvious answer is only if it delivers close to 100 percent compatibility with close to 100 percent or better of the performance of Mac applications on today's Mac OS—and with better stability than today's Mac OS. But I'd also look for three other vital signs. One is success in educating Mac developers in what amounts to an entirely new platform. Second is a compelling applications-server platform. Corporate buyers are unlikely to buy just a desktop OS at this point; even Microsoft is having to converge its desktop OS (Windows 95) with its high-end/server OS (NT). The third sign is a third-party constellation of system, network, and storage management software that exploits NextStep's capabilities.

Will Apple developers remain faithful? That depends on the degree to which Apple shoulders their burdens.

Those goals will not be easily met. After all, on paper Rhapsody doesn't sound startlingly different from Windows NT. And right now it has a tiny stable of developers and applications. Meanwhile, will Apple developers stay the course and remain faithful? That's going to depend on the degree to which Apple shoulders their burdens.

What's at stake here is the continued survival of several advanced technologies. PowerPC processors consistently outperform Intel chips. OpenStep is one of the best development environments out there. The Macintosh may have lost some of its luster in the user-interface department, but it still sets the standard.



In today's Webbed world, close links between content creators, applications developers, and system administrators would be desirable. A successful Rhapsody will contribute to that. And it will give Mac developers an entrée into cross-platform developing, if Next or someone else does a good job of supporting that in the new environment.

Judging by my e-mail, Apple's die-hard customers tend to see things in terms of vengeance and retaking the market lead from the evil empire in Redmond. That's unrealistic at this point. But the information-technology community does have an interest in seeing a revived Apple, riding on a reborn OS, that would continue to push the envelope for us all. **B**

Mark Schlack

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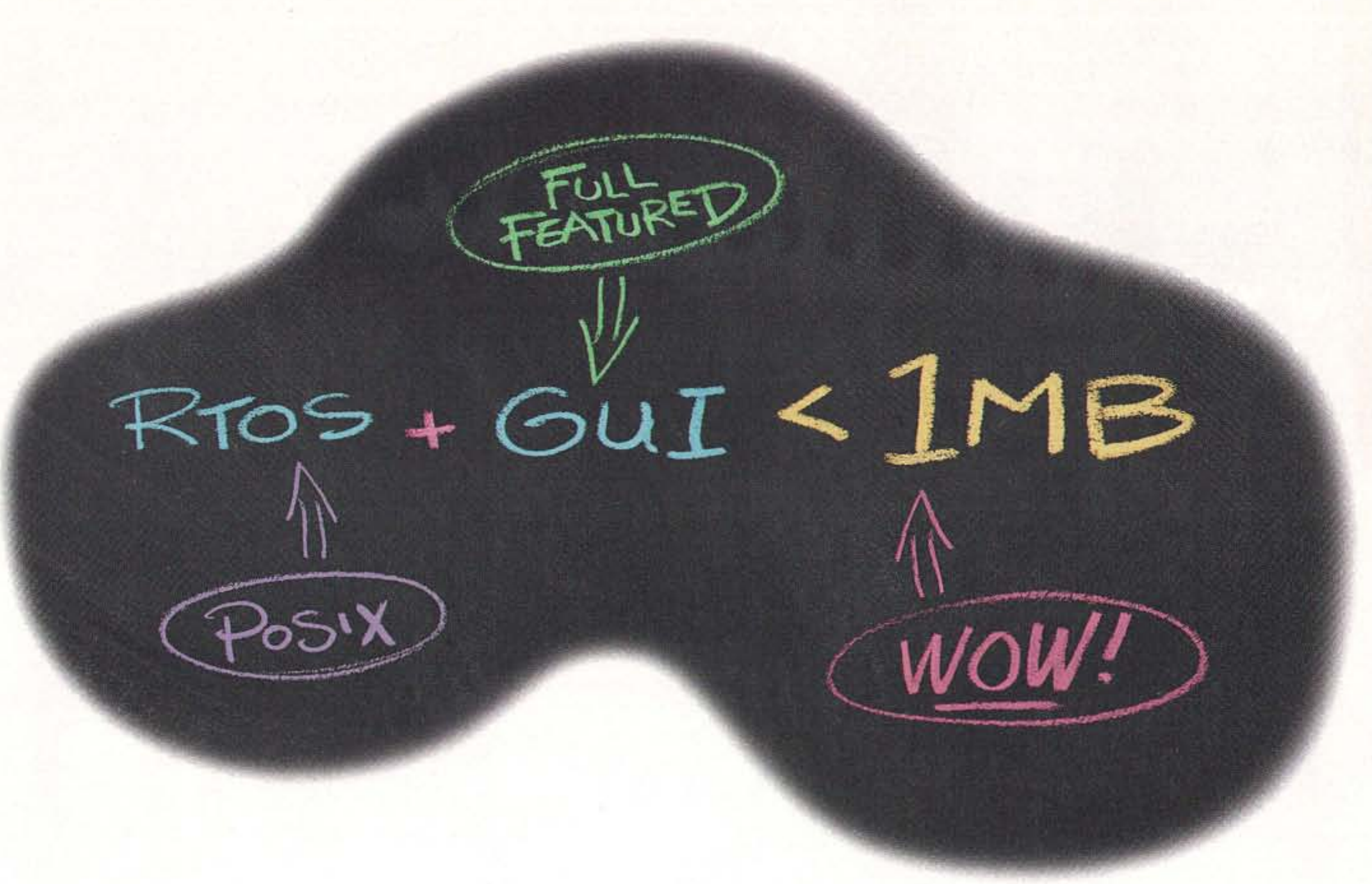

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inbox

Pine Came First

After reading "E-Mail Grows Up" (December State of the Art), I want to point out that long before Netscape began thinking about the POP3 protocol, people at the University of Washington developed Pine (Program for Internet News and E-mail). It's a client for handling messages using the SMTP, POP3, IMAP, and NNTP protocols and the RFC-822 and Multipurpose Internet Mail Extensions (MIME) formats. Although it's not all bells and whistles, it runs well under Windows and OS/2 and costs nothing. For more information, see http://www.washington.edu/pine/.

The companion article on Secure IP ("Internet Armor") was just great. I'm looking forward to a non-American replacement for my Windows Winsock.DLL.

Kamil Kukura
Czech Republic
kamk@madonna.unicom.cz

Thanks. Readers should note that the University of Washington's Office of Computing & Communications develops and supports Pine for several flavors of Unix and for DOS and Windows, but it doesn't directly support the versions for OS/2, VMS, or the Amiga. —Eds.

Moore's Law Revealed

"The Birth of a Chip" (December) by Linley Gwennap was a pleasure to read. However, you say that Moore's Law states that chips double in power every 18 months. That came as a surprise to me. Intel's Web site says that in 1965, Gordon Moore predicted transistor density on microprocessors would double every two years. Just to be sure, I drew a graph and made a few calculations. The number of transistors has doubled every 2 to 2.1 years for the past 25 years!

Hans Meijer
Zoetermeer, The Netherlands

Moore's Law has been interpreted to mean so many things over the years that Gordon himself has admitted he's unsure of the exact meaning. His original 1965 article focused on the doubling of transistor counts every two years. If you focus on microprocessor performance, however, the improvement is at the faster rate of doubling every 18 months because the increase in transistor count is abetted by an increase in clock speed, both of which contribute to overall performance. As this increase is driven by Moore's Law, it is treated as a corollary to Moore's Law, or even as Moore's Law itself. In fact, we combined the two variations in the article; we should have specified a two-year doubling when speaking of transistor densities. —Linley Gwennap

The table "4004 vs. Pentium Pro" in "The Birth of a Chip" is confusing. If there are 2300 transistors on a 4004 with a 12mm^2 surface area (191 transistors per mm^2), and 5.5 million transistors on a Pentium Pro with 196mm^2 (28,061 transistors per mm^2), then the transistor density has increased 146-fold. At the same time, the feature size has decreased from 10 to .35 microns, or about 28.6 times, so the feature area (10^2 vs. $.35^2$) should be over 800 times smaller. Why then has the transistor density increased only 146 times?

Daniel Cincunegui
dcincu@cadxpress.com.ar

Early chips such as the 4004 had relatively simple designs that were laid out entirely by hand, resulting in little wasted space between the transistors. Modern microprocessors require more space devoted to routing—the interconnects between transistors—and are typically laid out using automated tools, which are not as efficient as hand routing. These factors have prevented transistor density from simply tracking the square of the transistor size. Note that the Pentium Pro cache chip, which uses a very simple design laid out by hand, crams 31 million transistors into a 242 mm^2 die, giving it a transistor density 670 times that of the 4004, closer to the 800x improvement you calculated. —Linley Gwennap

Mastering NT Domains

In "Unearthing Cairo" (November Special Report), Mark Minasi writes that an NT network of six domains requires 30 trust relationships, and an organization with 50 domains requires an unmanageable 2450 trusts. In both cases he assumes that

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the domain model requires that all domains trust each other. The division of user accounts into a small number of master domains, with hardware resources in dispersed resource domains, is a standard practice in enterprise domain design. An organization of 30 domains requires as few as 29 trust relationships, with all resource domains trusting a single master to authenticate users. As long as resource domains trust a common master, any user with sufficient permission can access any resource.
Mark Lloyd
Seattle, WA

You are right in that the "complete trust" model isn't the only possible one. But even a master or multimaster domain model requires setting up and maintaining a number of trust links. If you mean to imply that nothing is broken with the current model, you may find that managers of small NT networks are likely to agree. But Microsoft clearly doesn't agree; hence the company's new hierarchical domain structure, which was named Active Directory after the article went to press.
—Mark Minasi

No Standards

Regarding "New Software: Dead or Alive?" (December Inbox), there are well-defined standards for mailing, such as RFC-822 and x.400, which are ignored by even the likes of Microsoft. Just sending plain text messages between systems can cause problems when a mailer uses proprietary codes for end-of-line breaks or strings an entire paragraph of text together as one continuous line. Many mail systems can't handle that. And why should they? Such messages clearly bend, if not break, the rules. So what hope for schedulers and the like working internationally? None while the major players dither over compatibility. The problem is that it is in their own interests to be proprietary.
Derek Grainge
Systems Manager,
Wellington College
Crowthorne, U.K.

A Girl with a Cat

The final question of the interview with Sangam Pant, vice president of engineering at Lycos (December Bits), looks naive in its ignorance of one of the great mysteries of nature: vision. Today, thousands of bright but frustrated researchers are working on computer vision and image understanding. Frustrated because what we do works only in simple toy problems, and we, like anyone else, don' t have a clue as to why we see, let alone how to translate this extraordinary gift into a dumb algorithm. And frustrated also because you asked with indifference if Lycos is "actually doing the equivalent of optical character recognition on the image" by looking at the bit map and determining that "it's a girl with a cat." OCR can now be reasonably accomplished on a single chip. We humans have more than 20 billion highly interconnected neurons dedicated to vision. You can figure out the difference for yourself.
Maurizio Pilu, Ph.D.
Digital Media Department
Hewlett-Packard Laboratories
Bristol, U.K.

I did not mean in any way to slight the research community. I chose the phrase "equivalent of OCR" because it was an analogy that many nonspecialists would understand. Mr. Pant seemed comfortable with the question, and as his response indicates, is well aware that such an undertaking is currently unfeasible. I asked the question because I do appreciate the magnitude of the task and wanted to make it clear that Lycos is not doing image analysis but rather is analyzing the links that point to the images, sounds, and video clips. —Dave Andrews, news editor

Photoshop Review Reviewed

I am surprised by the technical errors and omissions in your review of Adobe Photoshop 4.0 ("A (Re)Touch of Genius," December). Layer masks are not new to Photoshop 4; they were introduced in version 3.0. They are not applied "to a selection within the layer"; they are specific to the entire layer to which they're attached. When using Actions, mistakes that occur during the recording process can often be corrected by editing the final Action itself instead of, as you suggest, "Recording Again." You can indeed merge adjustment layers; there must be a target image layer underneath the adjustment layers you want to merge. While it's true that you cannot "combine" the color/brightness corrections introduced by multiple adjustment layers into a single adjustment layer, keeping them separate allows the adjustment layers to be reordered at any time. This is more useful than simply merging adjustment layers. Adjustment layers do work with masked layers.

The sidebar on the Digimarc image watermark encryption technology in Photoshop is also inaccurate; applying a simple Gaussian blur to an encrypted image renders the encryption unreadable. You can add text to an existing layer by selecting the selection mode for the text tool while the desired target layer is active. True, you must fill the text with the desired color as a separate step; it would be nice to not have new layers generated when creating text in the default mode.
David Biedny
idig@nbn.com

I'm aware that layer masks appeared in version 3.0; the impression that it is new with version 4.0 was due to an editing error. A mask can be applied specifically to selected objects within a layer; the drop-down menu even includes selections to hide or reveal the objects. While you can correct mistakes by editing final Actions, it's often easier to "Record Again," especially in complex revisions. An adjustment layer can be merged to the target layer below, but my point was that multiple adjustment layers cannot be merged to the same target layer, short of merging all the layers. Adjustment layers did not work with masked layers in the beta software I reviewed. They do in the shipping version. According to Digimarc, watermarks survive normal edits, including sharpen and blur, scale, crop, color separation, and file-format conversion. Finally, regardless of which layer is selected, text is placed on its own layer for ease of manipulation. When adding lots of text, this feature is cumbersome. In that situation, adding the text to

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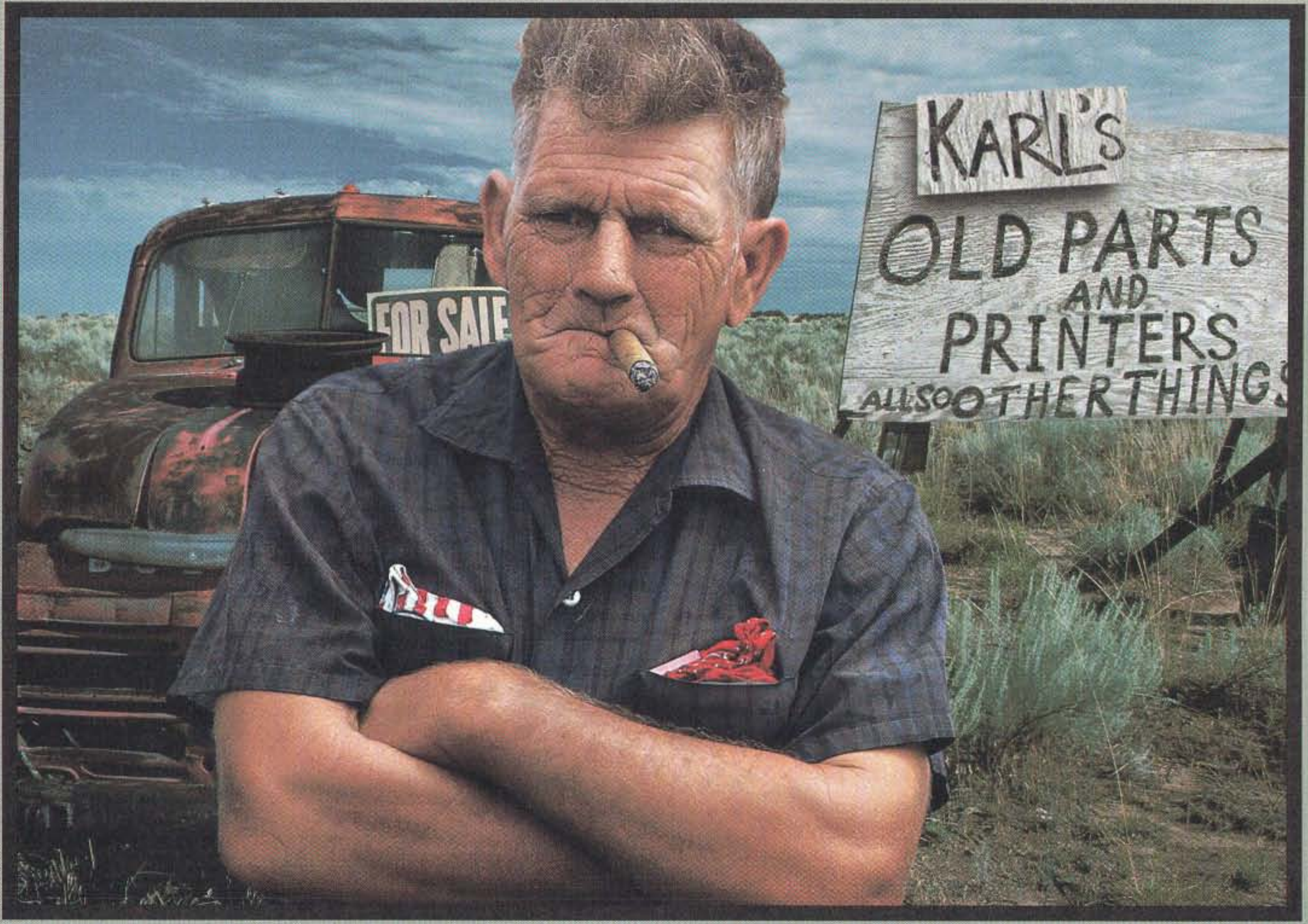

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one target layer and refilling with color would be equally cumbersome. —Joy-Lyn Blake, production assistant, The BYTE Site

FIXES

In "Apple Achieves Notebook Parity" (December Bits), the clock speed of the PowerBook 1400's 603e PowerPC CPU should be 117 MHz, not 177 MHz. The unit also has a 16-bit display, not a 32-bit display as stated.

In the "Editors' Choice Awards" (January, page 132), we misidentified the product name and the company responsible for Emultek' s simulation and training tool. The correct product name is Rapid ST; it is made by Emultek; Jerusalem, Israel; phone + 972-2-870770; http://www.emultek.com/.

In the same article we also mislabeled Acer America's new notebook. The correct name is Nuovo. We regret the errors.

COMING UP IN APRIL

COVER STORY

The Truth About Network Computers

The definition of the PC is expanding to include network computers, terminals, and Web appliances for business, education, and home users. We explain how these devices differ, what they do well, and what they don't.

FEATURES

Managing Complex Data

We'll devote a series of stories to how DBMS technologies are evolving to include graphics and even video, how data blades and similar technologies extend traditional RDBMS engines, and what to expect in the future.

SPECIAL REPORT

Building with Components

BYTE surveys the advances in tools and middleware that exploit component technology for faster, cheaper application development. We'll also examine the key issues in choosing between CORBA and Microsoft's Active Platform, or using both technologies cooperatively.

REVIEWS

Merchant Web Servers

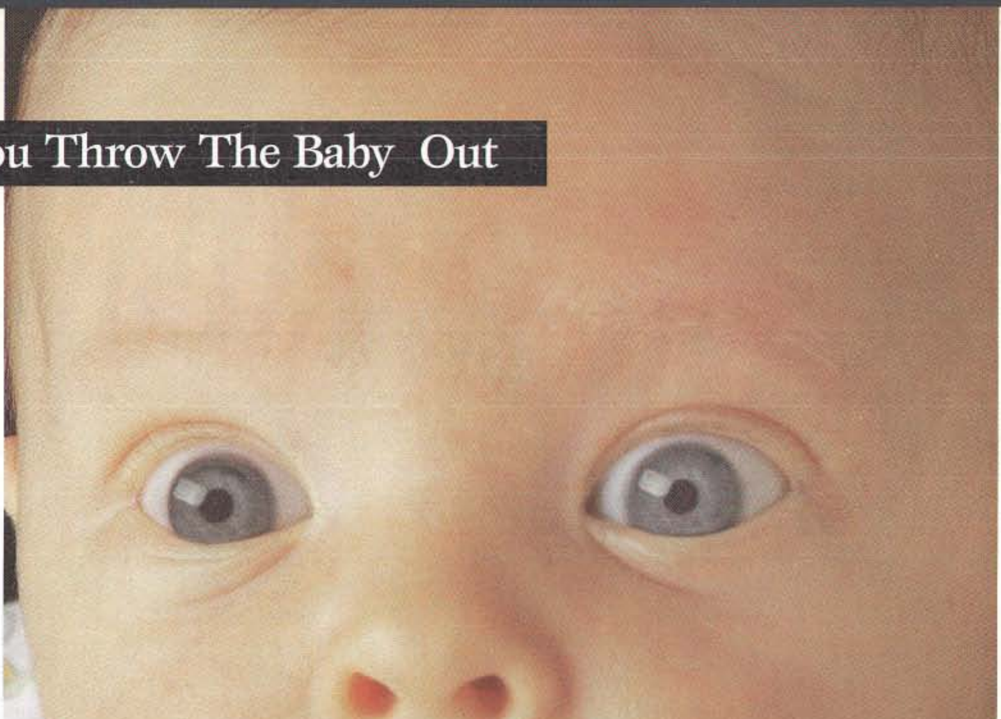
We test programs that manage not only the window dressing for your virtual storefront but also the complex billing and state-maintenance functions.

Java SDK 1.1.

The popular Web language gets new classes in a rewritten Abstract Windowing Toolkit, a new just-in-time compiler, and JavaBeans component technology.

Tools for Developing Embedded Systems

Specialized microprocessors aren't just in factories anymore—they're the power behind PDAs and set-top Web boxes. Here's the scoop on software tools for writing to the new embedded platforms.



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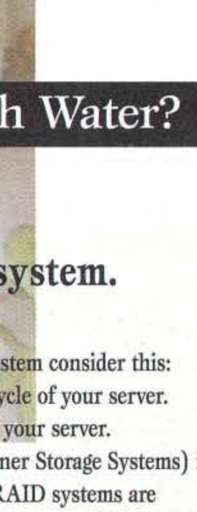

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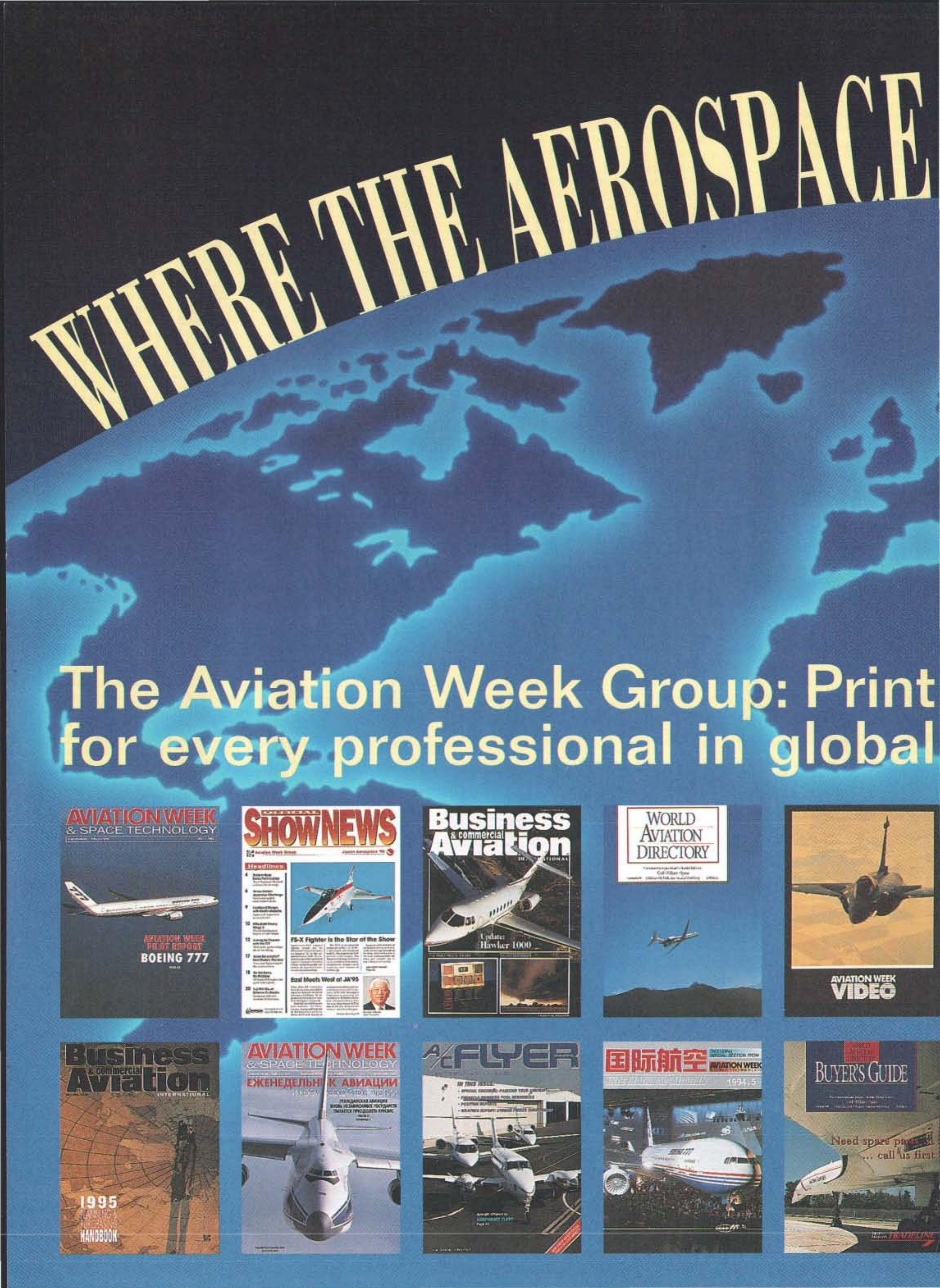
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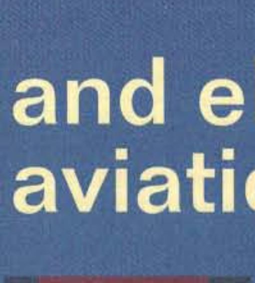

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PC 97 Road Map

Microsoft's planned upgrades of its Windows OSes portend changes to a wide variety of PC components.

The Internet seems to redefine practically everything these days, even the basic definition of the PC itself. Microsoft has added a fourth category of PC, called the NetPC, to its set of recommended hardware specifications for running the next versions of Windows 95 and NT. The specifications (for highlights, see "The Four Varieties of Windows PCs") describe the minimum requirements that a PC must satisfy to qualify for the "Designed for Windows" logo in one of four varieties of PC. Although the final specification for the NetPC wasn't slated for release until February, preliminary indications are that it will be a sealed PC, which means you won't add new peripherals to the NetPC by opening its case—instead, you'll add new hardware via an external bus, for example, the universal serial bus (USB). The NetPC also makes a floppy drive optional. The NetPC and other network-centered technologies join initiatives such as improved power management and instant accessibility, which Microsoft and its partners have planned for PCs this year.

The Four Varieties of Windows PCs

Basic PC 97: 120-MHz Pentium, 16 MB of RAM, hardware support for OnNow initiative, USB port, support for MPEG-1 playback, graphics adapter capable of 800- by 600-pixel, 16-bit display.

Workstation 97: 166-MHz Pentium with an L2 cache of at least 256 KB, 32 MB of RAM, hardware support for OnNow, USB port, 1024- by 768-pixel by 16-bit display.

Entertainment PC 97: 166-MHz Pentium with an L2 cache of at least 256 KB, 16 MB of RAM, hardware support for OnNow, two USB ports, one 1394 port, 1024- by 768-pixel by 16-bit display.

NetPC: 100-MHz Pentium, sealed PC with a network connection, VGA adapter, hard drive to cache information locally, support for a mouse and keyboard, and 16 MB of RAM. A floppy drive is optional.

By establishing a NetPC standard and through its Zero Administration for Windows (ZAW) initiative (see the interview on page 40), Microsoft hopes to help companies reduce the cost of PC ownership. A key attraction of network computers, whether they conform to Microsoft's, Oracle's, or another definition, is reduced management costs.

ZAW adds support for such features as automatic system updates and application installation and central administration to the next version of Windows 95 (code-named Memphis) and NT 5.0 (currently slated to ship in the second half of this year). Without a floppy drive, a NetPC will help prevent the installation by end users of unauthorized software.

geek mystique

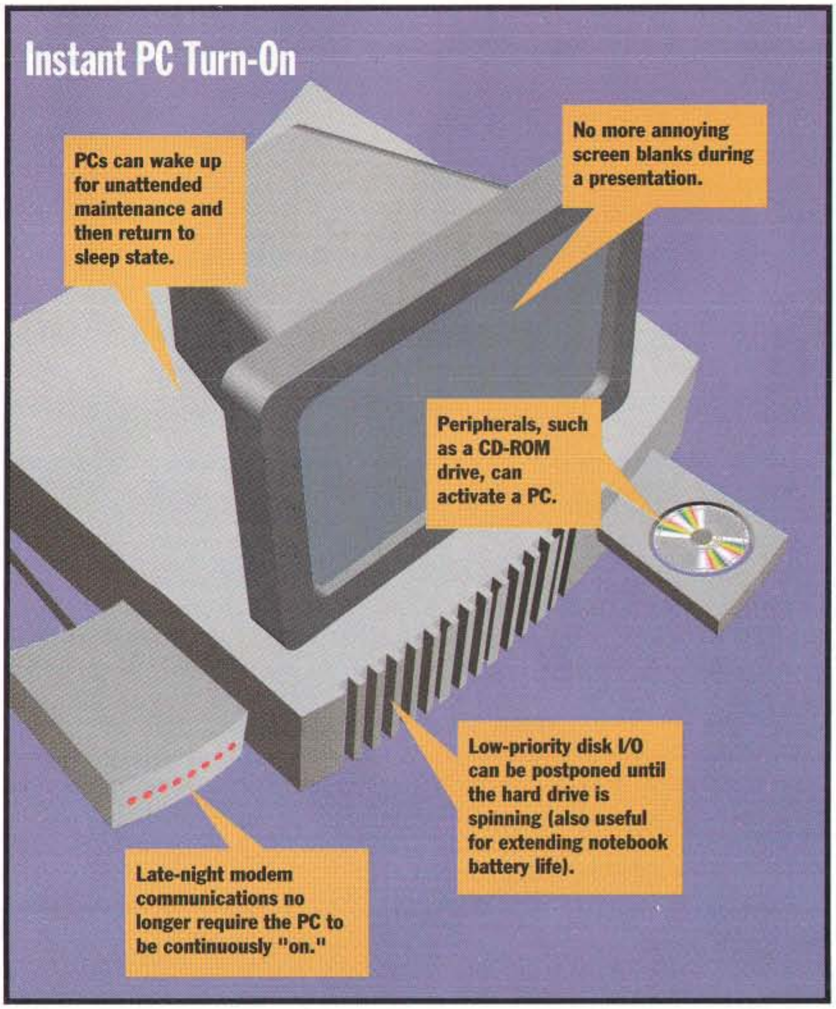
Geek Greetings

The ever-increasing influence of computer technology on our everyday lives exhibits itself in small but telling ways. One custom that high technology is starting to affect is the exchange of holiday greeting cards. More technology-savvy revelers eschew environmentally unfriendly greeting cards made out of paper and instead send e-mail messages. These e-mailed holiday messages may or may not include a uniform resource locator (URL) pointing the recipient to the sender's Web site.

Things were looking good for the environment when a BYTE editor remarked that he'd received six times as many electronic greeting cards in 1996 as in 1995. Unfortunately, further investigation revealed he received only one electronic holiday card in 1995, so the 600 percent increase sounds bigger than it really is. The final tally of greetings received at work or home:

- **Holiday greetings received electronically: 6**
- **Traditional greeting cards with food: 4**
- **Traditional greeting cards with clothing: 1**
- **Traditional greeting cards (stand-alone): 87**

Note that work-related e-mail messages that had holiday wishes or sentiments tacked on the end of the message were not counted, as those numbered way up in the hundreds. **–D.A.**


Instant PC Turn-On
PCs can wake up for unattended maintenance and then return to sleep state.
No more annoying screen blanks during a presentation.
Peripherals, such as a CD-ROM drive, can activate a PC.
Low-priority disk I/O can be postponed until the hard drive is spinning (also useful for extending notebook battery life).
Late-night modem communications no longer require the PC to be continuously "on."

Microsoft hopes OnNow will allow for instantly accessible PCs with smarter power management.

The NetPC and ZAW are but two changes that Microsoft and its many hardware partners have on tap for the PC landscape this year. Through its OnNow initiative, Microsoft is introducing a systemwide approach to PC and device power control. OnNow relies on the Advanced Configuration and Power Interface (ACPI), which is the foundation that enables the OS, instead of the BIOS, to direct power management. "Certain functions like power management require information about how the system is being used, including applications, drivers, and the user's expectations," says Mike Flora, Microsoft hardware evangelist. "The BIOS does not have access to this information."

By putting power management into the OS, Microsoft says PCs will get smarter about turning devices on and off. OnNow lets applications communicate to inform the rest of the PC what the user is doing, instead of the more traditional approach, in which the hardware and BIOS's power management functions are transparent to the application. Thus, OnNow should eliminate annoying occurrences such as your screen going blank in the middle of a presentation and delays when hard disks spin up unexpectedly. Also, an OnNow-compliant application can check to see if a notebook is running on batteries, and if so, turn off nonessential background tasks and postpone low-priority disk I/O to preserve battery life.

OnNow puts the PC into a low-power sleep state instead of shutting it down completely. But once in this low-power state, the system will return to its working state quickly. When an OnNow-compliant peripheral is needed (e.g., a modem for a late-night file transfer), it turns on quickly, performs its task, and goes back to its sleep state. OnNow will also help PCs fit in better in the consumer world—inserting a tape into a PC-attached VCR will turn on the computer and other devices such as the display and sound card.

All these initiatives will require a host of changes to the Windows OSes, hardware, firmware, and applications. For one thing, NT 5.0 and Memphis will share a common device-driver model called the Win32 Driver Model. PCI and 1394 will require new power management specifications, a process that's under way. Applications will need to be rewritten to take advantage of OnNow. Windows 95 and NT will further converge. NT 5.0 will get the same power management and Plug and Play capabilities as Memphis.

PC makers say the time frame for certain features specified by Microsoft's PC 97 definitions is still subject to change. By midyear, the USB should be widely supported by PCs, but 1394 may not be a mainstream technology until 1998.

At press time, it was unclear to what extent today's applications and hardware will be compatible with the PC architecture of the future. Already, certain technologies included in an OEM version of Win 95, which is available only to PC makers for bundling on their new PCs, are incompatible with current applications. For example, disk utilities released in 1996 aren't compatible with the FAT32 file allocation table. Although the technologies planned for PC 97 promise to make computers more accessible to beginners and easier to manage, many pieces that make up the PC puzzle will need to be upgraded. **–Dave Andrews**

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PC Phones Add Power

New devices for the small office/home office (SOHO) market can better help you keep in touch, whether you're working in the office or on the road. These products combine software with add-in boards or stand-alone devices that connect to a computer. Both types of telephony devices tend to include a high-speed modem for Internet access, a speakerphone with voice mail, fax send and receive capability, and message forwarding.

One external product is the $239 TelePort 33.6 Speakerphone/Fax/Modem from Global Village ((408) 523-1000; http://www.globalvillage.com), available in Mac and Windows versions. The sleek-looking TelePort (see the photo) offers easy access to its controls (on/off, volume, and mute). It lets you answer speakerphone calls even if your computer is turned off.

Global Village's included FocalPoint software lets you fax, manage voice mail with multiple mailboxes, and remotely access voice mail or e-mail. It can also notify you via page or fax of new voice mail, e-mail, or faxes. The device supports simultaneous voice and data (SVD), but not caller ID.

The $399 ComCentral 33.6 from IBM ((800) 426-2968; http://www.pc.ibm.com) resembles a souped-up answering machine that connects to your PC. This device includes dual-line support and caller ID. It has a built-in 33.6-Kbps modem. Because it has its own memory (up to 8 MB), the ComCentral will receive voice mail or faxes when your PC is off, a feature that's relatively uncommon in these devices. Included software lets you manage faxes and calls from your PC or directly from the ComCentral. Features include fax and voice-mail forwarding, remote message retrieval/notification, and support for up to nine outgoing announcements.

The Personal Assistant (we looked at the beta version) is a full-featured phone for PCs running Windows 95 that supports what might be called power-calling; that is, the ability through caller ID to instantly profile users, maintain call logs, and so on. Mitel ((613) 592-2122; http://www.mitel.com/mpa) is counting on the idea that the $349 phone (which includes software and an internal 33.6-Kbps modem) is mightier than the PC, so to speak. "The phone is still the number-one business tool," says Peter Couse, product line manager for Mitel's Personal Assistant.

TelePort combines a fax/modem, speakerphone, fax-back, and more.

Boca Research ((561) 241-8088; http://www.bocaresearch.com) already offers modems such as its new 33.6-Kbps Game/Business Modem (internal version, $119; external version, $129), which offers support for business-related features such as caller ID, paging, remote retrieval of fax and voice messages, applications conferencing with simultaneous voice and data, and support for as many as 10 voice mailboxes. The company's $199 Video Phone Classic (the price includes the board and software) allows videoconferencing over plain old telephone service (POTS) lines and the Internet. Also, the company's SoundExpression 28.8 combines PC telephony and Internet phone software in one package.

In the future, look for companies to add moving pictures to their PC telephony products. Joseph Preisser, the program manager for the IBM group that markets the ComCentral, echoed the sentiments of most vendors when he says possible future capabilities include Internet phone and videoconferencing. However, Preisser says that most of these products are aimed at the SOHO and remote-user markets, where the demand is currently stronger for telephony than for videoconferencing.

With these new products, as well as PCs expected this spring that will offer more robust telephony and videoconferencing solutions, your small or home office can make much better use of the telephone.

–Jon Pepper

future watch

What's Next for Apple? Rhapsody

After canceling plans for Mac OS 8 (aka Copland) in favor of semiannual system updates, Apple will now buy Next Software and use elements of the NextStep OS to provide essential parts of the next-generation Mac OS. Next's OpenStep Enterprise and WebObjects development environments, plus Next's support for multiple platforms, were key reasons for the acquisition, according to Apple. The company now has a dual-OS strategy. Updates to Mac OS 7.x will ship about every six months while Apple works on the next-generation OS (code-named Rhapsody).

Apple's Mac OS 7.6 update includes elements such as integration of OpenDoc 1.1 and CyberDog 1.2, Apple's suite of OpenDoc-based Internet components. However, the company's OS has fallen behind with its lack of support for preemptive multitasking, multithreading, symmetric multiprocessing (SMP), and other features considered de rigueur in the late 1990s. NextStep does support multithreading and preemptive multitasking, but not SMP. However, Next proponents point out that the Mach kernel upon which NextStep is based is SMP-capable—it just hasn't been enabled in the current version of NextStep. Apple says it will include support for SMP in the next-generation OS, but it hadn't decided which kernel to use. These and other questions will be answered later this year.

At press time, Apple said Rhapsody will be released in early 1998 and should provide strong backward compatibility with current Mac OS software. Apple says it will ship a release for developers this year. Apple is hoping Next technology and Steve Jobs, who returns to the company he cofounded, will restore the luster to the Mac OS. Meanwhile, wannabe Apple acquisition target Be says it is working on technology to support Mac applications running on the BeOS and PowerPC hardware. **–D.A.**

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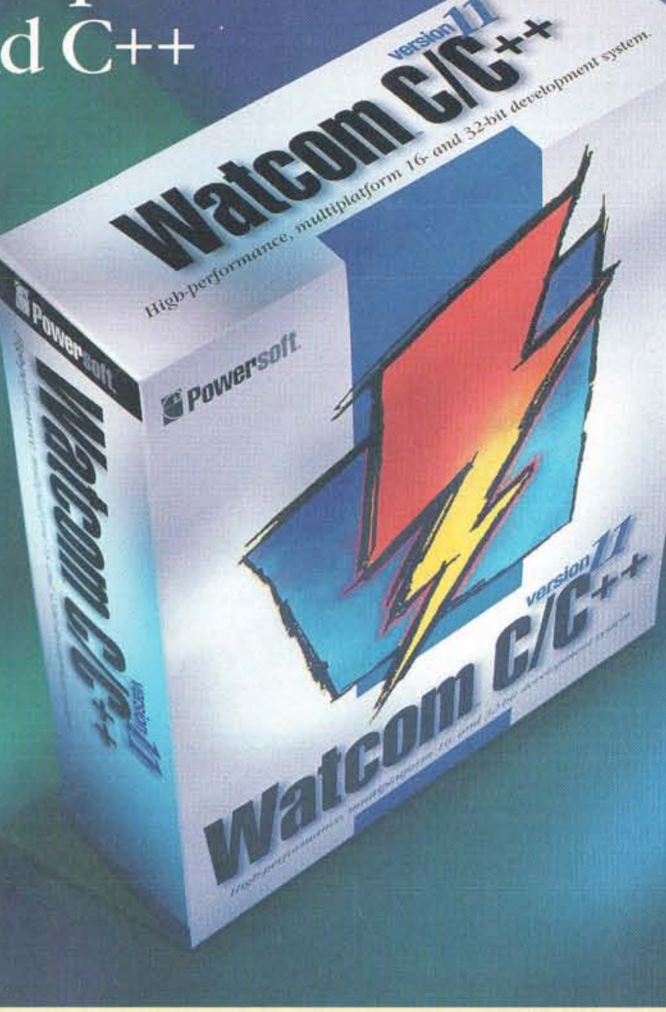
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What's Next for Video Conferences

Although prices continue to drop, technical and social obstacles must still be addressed before desktop videoconferencing becomes as common an application as making a telephone call. Products that comply with the H.323 standard for audio/videoconferencing over intranets and packet-switched networks will appear this year. With reduced prices and the arrival of this first wave of H.323-based LAN/WAN products, companies will test and evaluate how desktop videoconferencing can improve their business, according to analysts and vendors.

If price was a major obstacle in 1996, look again. For example, Philips' H.323-compliant EasyCam (for Pentium PCs with a 33.6-Kbps modem) costs $399, compared to $499 last year. EasyCam ((408) 453-7373; http://www.pps.philips.com) bundles a color desktop camera, an audio/video capture board, and CuSeeMe software for IP-based videoconferencing. H.320-compliant solutions for ISDN videoconferencing such as PictureTel's $1495 Live200p ((508) 292-5000; http://www.picturetel.com) and Vcon's $1895 Armada Cruiser 150 ((972) 735-9001; http://www.vcon.co.il) cost about $1000 less than last year. Microsoft plans to give away its IP-based NetMeeting 2.0 audio/videoconferencing software that's currently in beta testing. Also, entry-level H.324-compliant hardware/software packages for plain old telephone service (POTS) videoconferencing can cost $250 or less.

However, lowered prices for the desktop hardware and software won't guarantee widespread adoption, says Mike Clifford, vice president of sales for VCon, which expects to release a low-cost H.323 package this year. "Connectivity is a big issue," says Clifford. For H.323-based conferencing to become practical in business, many networks will need to be upgraded for greater throughput, support for quality of service (in routers), and gateways between the LAN and WAN.

H.323/H.320 gateways, which should soon be available from companies such as RADVision ((201) 529-4300; http://www.radvision.com) and VideoServer ((617) 229-2000; http://www .videoserver.com), extend your LAN videoconferencing to work with H.320 solutions. However, these gateways will be relatively expensive. For example, RADVision's L2W-323 (which handles up to four concurrent calls) H.323/H.320 gateway will cost $5950.

As more businesses use videoconferencing, the need for gateways and multipoint control units (MCUs) will increase. "Multipoint is a natural extension of the typical business meeting, bringing many participants together to make a decision," says Art Zeile, vice president of sales and marketing at Link-VTC ((303) 516-6103; http://www .linkvtc.com), which offers multiple-site videoconferencing services. Businesses that find current prices for MCUs and gateways too expensive may want to outsource services to companies such as Link-VTC, MCI, AT&T, or Sprint.

Desktop videoconferencing requires managers to consider numerous issues, ranging from time and expense in upgrading desktop PCs to effect on LAN performance, according to Christine Perey, principal for the Placerville, CA-based videoconferencing consultancy Perey Communications ((916) 621-0468). "But the technical issues, while not insignificant, are not the biggest issues," she says. "The big issue is human."

Videoconferencing today is often perceived as a WAN application, one that can save the time and cost of a meeting in another city. Yet videoconferencing over the LAN confers advantages even for employees who are working in the same building or campus, Perey says. With desktop videoconferencing, for example, participants can "meet" while having access to all their PCs' resources as they collaborate via application sharing, without having to reserve a room. In today's business culture, however, having an in-house meeting usually means leaving your office and PC and walking to a meeting room.

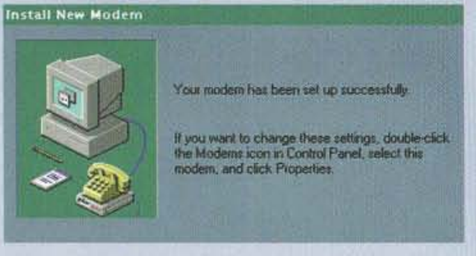
One trend that may help change the perception of where meetings are held is if inexpensive H.323-over-Internet or H.324 packages for analog phone lines become popular among consumers. Consumer-level products that deliver only 3- to 4-frame-per-second video will not provide the quality that many businesses will require, but these entry-level products could promote videoconferencing's overall acceptance in society. As social, economic, and technical barriers come down, videoconferencing at the desktop may finally achieve mass-market acceptance in the next two or three years.

–Curt Harler

Bug of the Month

Elusive Plug and Play

In an attempt to install a new modem to a Pentium PC running Windows 95, the installation program reported it couldn't find several files, including wsock32.dll and others. However, further digging showed that the allegedly missing files had all been present in the exact directories in which the installation program was reportedly looking. Several solutions proposed by the modem vendor's technical-support department left the PC confused. After another call, the user removed the modem from the PC and rebooted. The technical-support department suggested that this would clear things up. It was then that the installation program finally announced it had successfully installed the modem (see the screen). Unfortunately, the modem was at that point physically removed from the PC and in the user's hands.


Install New Modem

Your modem has been set up successfully.

If you want to change these settings, double-click the Modems icon in Control Panel, select this modem, and click Properties.

Deciding that the original target PC must be haunted by anti-Plug and Play demons, the user took the (now-removed) modem and installed it to another Pentium PC running Windows 95. The modem installed successfully in only 45 seconds. Calls to the modem vendor and vendor of the first PC never resolved the original problem. The user decided life was too short to pursue the problem further. **–D.A.**

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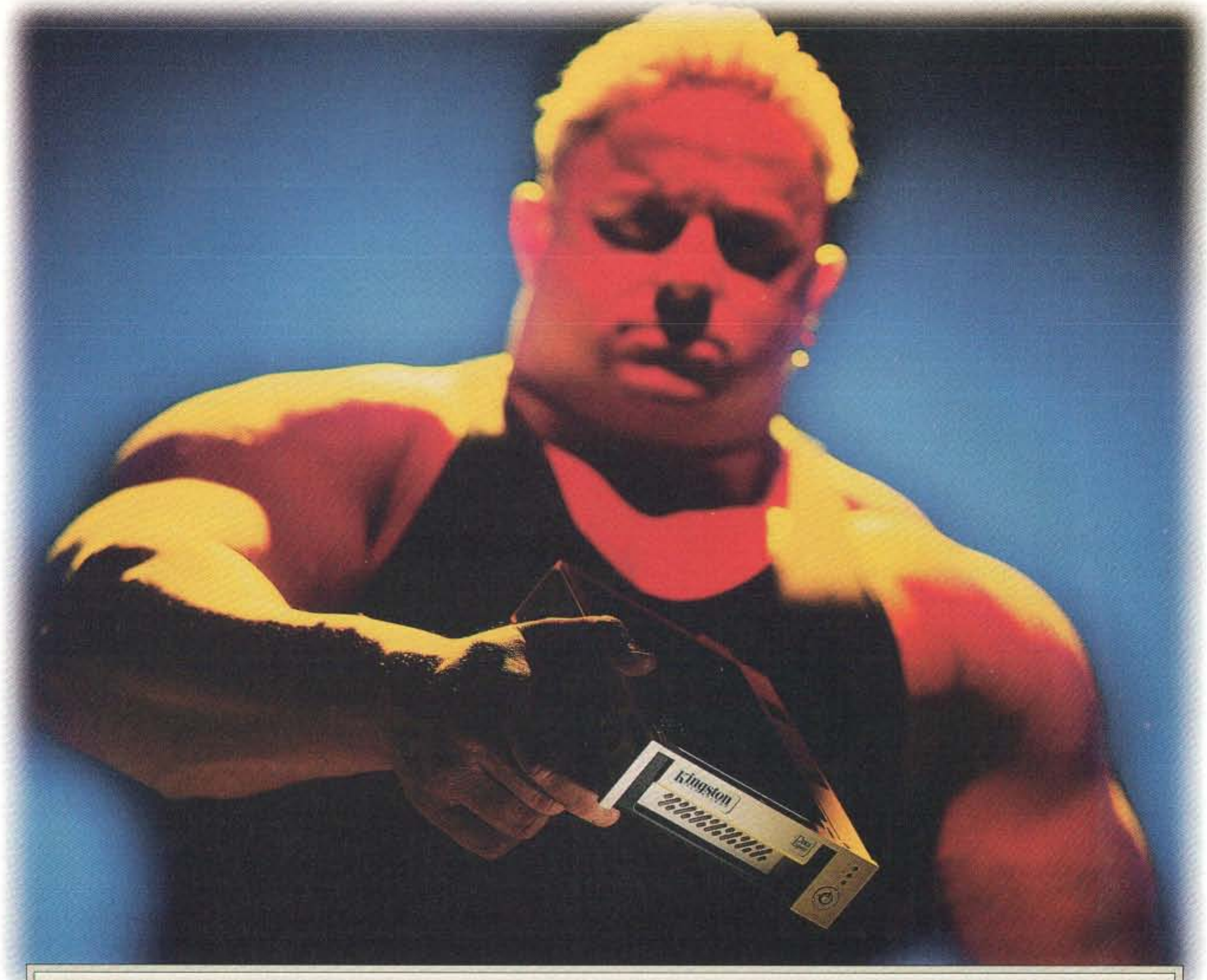

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Better Error Traps Coming for Coders

Along with more sophisticated, more modular, and more complex software components come more sophisticated, more modular, and more complex bugs. The companies that make the tools that track good old-fashioned array overruns and memory leaks are setting their sights on the more elusive errors that arise in development environments where third-party software components and mixed-language development are commonplace. NuMega's BoundsChecker and Pure Atria's Purify are the most popular run-time error-detection programs for Windows and Unix, but both companies realize that run-time memory-access checking is only one element of the developer's testing regimen.

NuMega Technologies' (Nashua, NH, (603) 889-2386; http://www.numega.com) recent acquisition of Marquis Computing gives the company a complete suite of Visual Basic error detection and analysis programs to run alongside BoundsChecker, which operates on software developed in C/C++ and Borland's Delphi. Marquis Computing's VBFailSafe and VBCodeReview give NuMega expanded coverage across component technologies, a key element of the company's strategy. "Virtually every piece of software calls something somewhere to do something," says Ed Sullivan, NuMega's director of engineering. "You need to be able to detect errors across the interface between these modules." BoundsChecker validates usage of most Windows APIs, including COM and ActiveX, so black-box testing of Visual Basic modules is possible with BoundsChecker alone. VBFailSafe is a BoundsChecker-like program for Visual Basic that gives developers a way to look inside the black box at the underlying source code.

VBCodeReview provides static analysis of Visual Basic code, a sort of Lint for Visual Basic. It can catch errors such as failing to restore the mouse pointer before exiting a routine. It can also warn you about known bugs in Visual Basic itself. The pairing of static- and dynamic-analysis tools enables developers to fix bugs that might otherwise escape detection. "The classic error is a memory leak with improper use of user-defined types," says Hank Marquis, the developer of VBCodeReview and VBFailSafe. Dynamic analysis can detect the leak; static analysis can warn about improper usage.

NuMega's efforts for the future, according to Sullivan, will focus on pairing static and dynamic code analysis across its products. Adding analysis of run-time traces to BoundsChecker will enable the product to diagnose errors that span threads in a multithreaded application, something that's not possible today. Also, while run-time analysis isn't needed with Java, static analysis could point out latent errors.

Pure Atria's (Sunnyvale, CA, (408) 720-1600; http://www.pureatria.com) growing suite of software test tools goes well beyond run-time error checking. The company's Unix-based tools include Pure Coverage, a code-coverage analyzer; Quantify, a performance profiler; Pure Performix, a load-testing tool that can simulate multiple users; and Pure Test Expert, a test suite manager. Pure Atria's

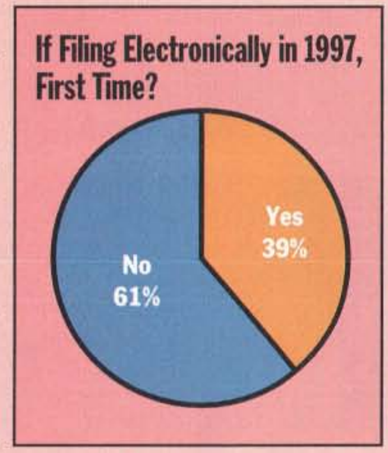
Survey

E-Filing Myths and Facts

In last month's survey, we learned that many people who use software to do their taxes are reluctant to file their taxes electronically using a computer. Most who file electronically do so for a speedier refund. However, comments collected from the survey indicate that some users' reasons for not filing electronically were based on incorrect assumptions. Here are some common reasons for not filing, with responses from Intuit, developer of tax-preparation software for the Mac and PCs, and the U.S. Internal Revenue Service.

Filing electronically increases your chances of an audit because less supporting documentation is sent than when filing using paper forms.

The IRS says that criteria for audits are identical whether you file electronically or not. According to the IRS, electronic filers are not more likely to get audited.



If Filing Electronically in 1997, First Time?

Almost 40 percent of electronic filers will e-file for the first time.

You still have to send paper copies to the tax software vendor, so what's the point?

It's true that you have to send in paper W2 forms and the 8453-OL form that has your signature. However, you now send that directly to the IRS, which should result in a faster turnaround than the old way of sending it to the software vendor who then forwarded it to the IRS. Also, electronic filing eliminates the slight possibility of error when the IRS rekeys data from a paper form. If you have to pay taxes, you still have to send in your check and Form 1040V. The IRS hasn't yet implemented electronic payments.

You can't be sure the IRS received your electronic return.

Actually, when you complete your electronic filing, you should receive an acknowledgment that includes a document control number confirming that you filed. This year, most computer software companies participating in computer filing will let you get that acknowledgment by computer (instead of snail mail) by dialing into a computer system within 72 hours of sending the return. When you file electronically, the system will double-check that your name and Social Security number match.

The cost of $14.95 is too much.

You should see that price reduced this year to $9.95 or lower by filing intermediaries.

I don't trust intermediaries with confidential information.

This concern is understandable. The IRS is investigating solutions to address privacy and security concerns in the future.

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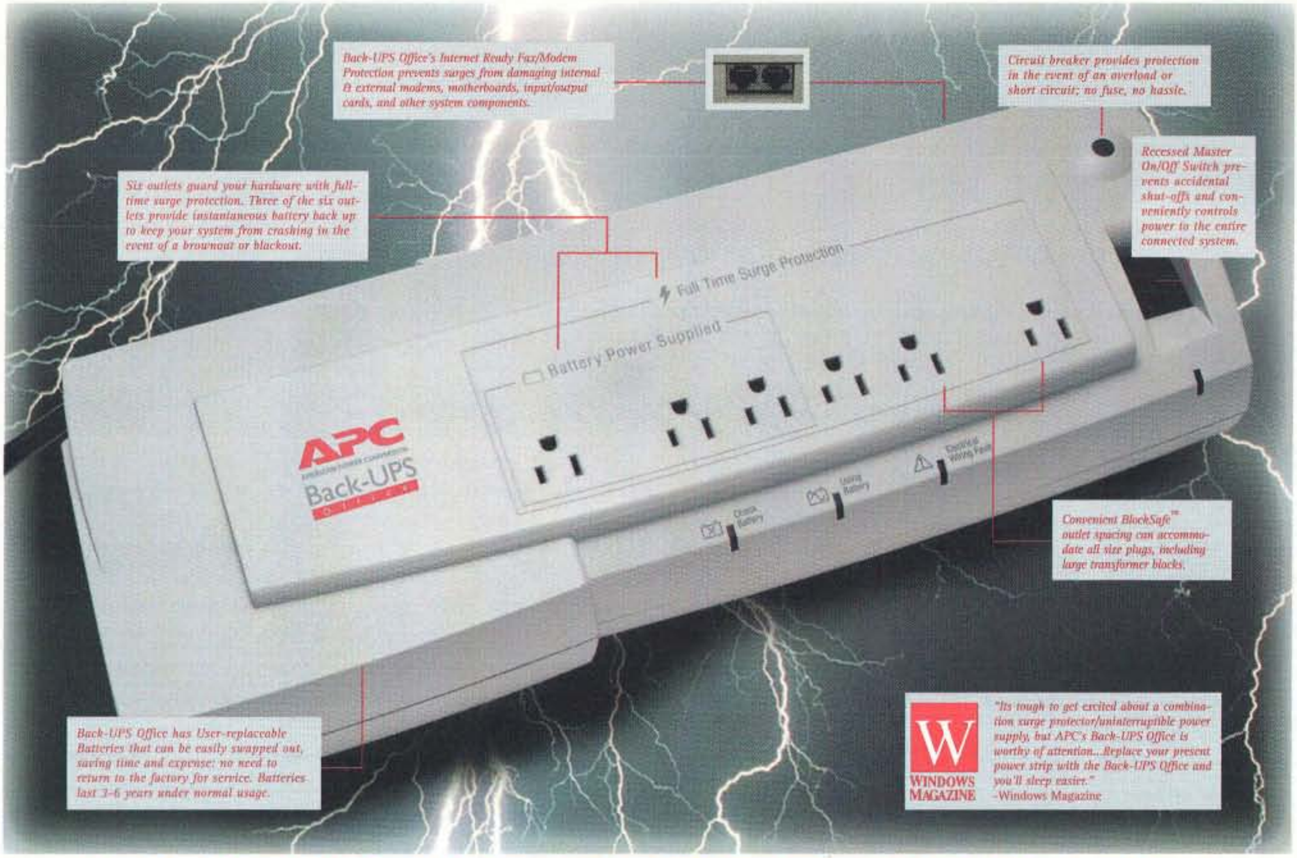

Back-UPS Office's Internet Ready Fax/Modem Protection prevents surges from damaging internal & external modems, motherboards, input/output cards, and other system components.

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WINDOWS MAGAZINE

"Its tough to get excited about a combination surge protector/uninterruptible power supply, but APC's Back-UPS Office is worthy of attention...Replace your present power strip with the Back-UPS Office and you'll sleep easier."
-Windows Magazine

At last, a safe place to plug everything: multipath Back-UPS Office for workstations, PC's and peripherals

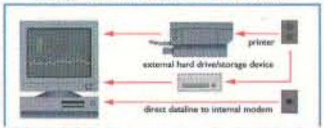
Power problems attack computers relentlessly. Did you know that you have a better chance of winning the lottery than of escaping power problems? They are the single largest cause of computer data loss and hardware damage.

Back-UPS Office provides clean, reliable power for your entire system. Instantaneous battery backup ensures uninterrupted operation of your CPU, monitor and an external storage device. Full-time surge suppression and site-wiring fault protection spreads a true multipath safety net under any remaining peripherals, like modems, printers, faxes and phone systems. Back-UPS Office also provides convenient BlockSafe™ outlet spacing to handle all size plugs – even large transformer blocks.

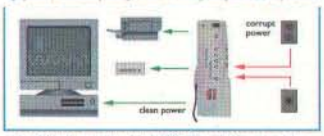
Unique multipath protection keeps your PC and data safe

Plugging phone lines or other peripherals into your computer increases your vulnerability to power problems. When a surge hits an unprotected peripheral, it can blaze down serial cables and datalines, and toast your expensive PC. Multiple peripherals and datalines to and from your system are vital, but dangerous. Without them you can't do your job. If a power sag locks your keyboard or reboots your computer before you've saved work, or while you are downloading from the Internet, you can lose data, time and money. Don't spend another late night at the office to meet your deadline. Join over 6,000,000 computer users worldwide who prefer APC to protect hardware and data.

Multipath Means Total Power Protection


printer
external hard drive/storage device
direct dataline to internal modem

Bad power (red) can enter a computer system through multiple paths – eg. printer, data and phone/fax lines – even if computer A/C is protected.



The Multipath protection of Back-UPS® Office™ shields your peripherals and guards your computer from bad power on every path, providing clean, safe power (green), to your entire system.

Back-UPS Office protects your entire system

Until now, protection for your entire system required several devices. Back-UPS Office means clean, safe power to every peripheral, and instant battery backup to keep your system from crashing. It means protection for less by integrating the security of a surge suppressor with the power of a UPS, guaranteed up to $25,000.

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Book Reviews

Five Guides to Better Site Building

Are you ready to improve your Web-site building skills? Five recently published books that are well written and organized will show you how.

Ambitious newcomers to site building might want to first read Sandy Ressler's *The Art of Electronic Publishing*. This book presents a good overview of the tools and techniques available to Web publishers. It covers much ground, from Hypertext Markup Language (HTML) to Virtual Reality Modeling Language (VRML), and everything in between. Unfortunately, that's also its biggest weakness: Ressler sacrifices depth for breadth. He provides little hands-on information about using the tools he describes. Numerous references to other sources—mainly Web sites—compensate somewhat for the lack of depth. Technically savvy Web novices will appreciate Ressler's logical organization, clear explanations, and unpatronizing style, however. The book gives a clear picture of how to approach your Web project.

Web Publisher's Construction Kit, by Jonathan Angel, is a Web publisher's introduction to Netscape Navigator plug-ins for end users and developers. End users will likely be thrilled just to have the bundled CD-ROM of plug-ins. Developers will learn just enough to implement the different data types on their sites; if you need more than basic competency for any one of them, you'll need a more focused reference. However, Angel does a good job of sorting out the wide variety of Netscape plug-ins.

Graphics can make or break a Web site, and the *Web Graphics Sourcebook* helps you use images wisely. This soup-to-nuts, hands-on guide will teach you everything from how to scan images to building a Shockwave animation. (For advanced topics such as VRML, however, you'll need a more specific reference for greater depth.) The tips included in the *Web Graphics Sourcebook* will help you work faster and use graphics to enhance a site rather than get in the viewer's way while avoiding copyright problems.

You can't talk about Web building these days without mentioning Java. Those ready to go beyond HTML should check out *The Visual J++ Handbook*, which is essentially a supplement to the Microsoft J++ documentation. It takes you through installation and basic structure, and into building simple multimedia applications (you will have to look elsewhere for advanced techniques). Having code on a floppy disk or CD-ROM would have been useful, but none of the examples are onerously long.

Site content resides on a server, which has its own setup and maintenance routines. Novices will find *The Web Server Handbook* an excellent introduction to the topic, and it's a good introduction to building your first Web site in general. *The Web Server Handbook* breaks up the main server content by platform: Unix, Windows, and Mac. The bundled CD-ROM contains three popular shareware server packages and a trial version of the Website Windows NT server.

–Michael Nadeau

The Art of Electronic Publishing, by Sandy Ressler, Prentice-Hall, ISBN 0-13-488172-9, $39.95 with CD-ROM

Web Publisher's Construction Kit with Netscape Plug-Ins, by Jonathan Angel, Waite Group Press, ISBN 1-57169-049-2, $39.99 with CD-ROM

Web Graphics Sourcebook, by Ed Tittel, Susan Price, and James Michael Stewart, Wiley Computer Publishing, ISBN 0-471-15692-2, $44.95 with CD-ROM

The Visual J++ Handbook, by William H. Murray and Chris H. Pappas, AP Professional, ISBN 0-12-511915-1, $39.95

The Web Server Handbook, by Pete Palmer and Adam Schneider, with Anne Chenette, Prentice-Hall, ISBN 0-13-239930-X, $39.95 with CD-ROM

latest acquisition is Integrity QA Software, which will add a Windows 95–based GUI test driver for Java, Visual Basic, and C++.

Purify, which runs on Windows NT as well as a variety of Unix platforms, is a sophisticated run-time error-detection tool that uses Pure Atria's Object Code Insertion (OCI) technology to catch errors in both developer and third-party components. OCI instruments code at the object level, letting Purify locate errors in code for which the developer has no sources. "OCI allows us to get into the executable and track any memory reference that happens within the application," says Pamela Roussos, Pure Atria's director of product marketing, developer products. The recently released Purify 4.0 adds detection of static-memory errors and the ability to launch a debugger on error (i.e., Just-In-Time Debugging).

While Purify's low-level approach catches more bugs in less time, it also requires tracking object changes for a sizable matrix of OSes and platforms. "Part of the challenge with Purify and its OCI technology is keeping up [with those environments]," Roussos adds. Pure Atria's other challenges include a strategic focus on the Windows platform and improving the integration across its product line. Right now, some of Pure Atria's products, including Purify and Pure Coverage, are tightly integrated, but the entire collection has yet to gel into a unified suite. **–Steve Apiki**

Microsoft Goes for the Enterprise

Now that it has conquered the desktop, Microsoft is taking aim at the enterprise. The company is releasing several components that will make Windows NT a better OS for deploying mission-critical enterprise applications.

Microsoft's Active Server technologies, first announced in late 1996, provide the infrastructure services required to create robust applications on enterprise servers. Built on top of NT, these technologies address both the traditional services required for enterprise applications (e.g., support for transactions) and newer services (e.g., those provided through

EO75

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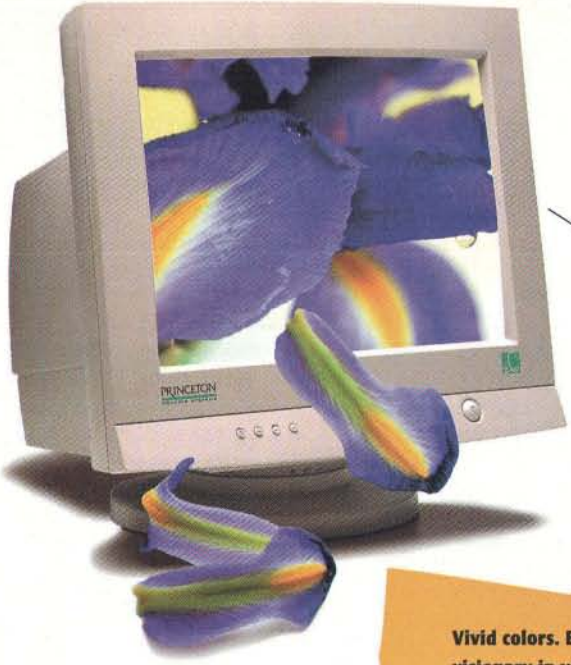

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Web technologies). With Active Server, Microsoft is making a serious assault on a very important part of the server market, which has been dominated since the late 1960s by IBM. IBM's venerable MVS OS, together with the transaction support provided by Customer Information Control System (CICS), underlies much of the world's business.

The key components of Active Server include:

- The Distributed Component Object Model (DCOM), which provides remote access to servers through remote procedure calls (RPCs).
- Microsoft Message Queue, which provides remote access to servers via the primary alternative to RPC, known as message passing.
- Microsoft Transaction Server (MTS), a key component that lets customers create transaction-oriented applications, much like CICS.
- Active Server Pages, supporting the creation of Web-based applications running on the server.

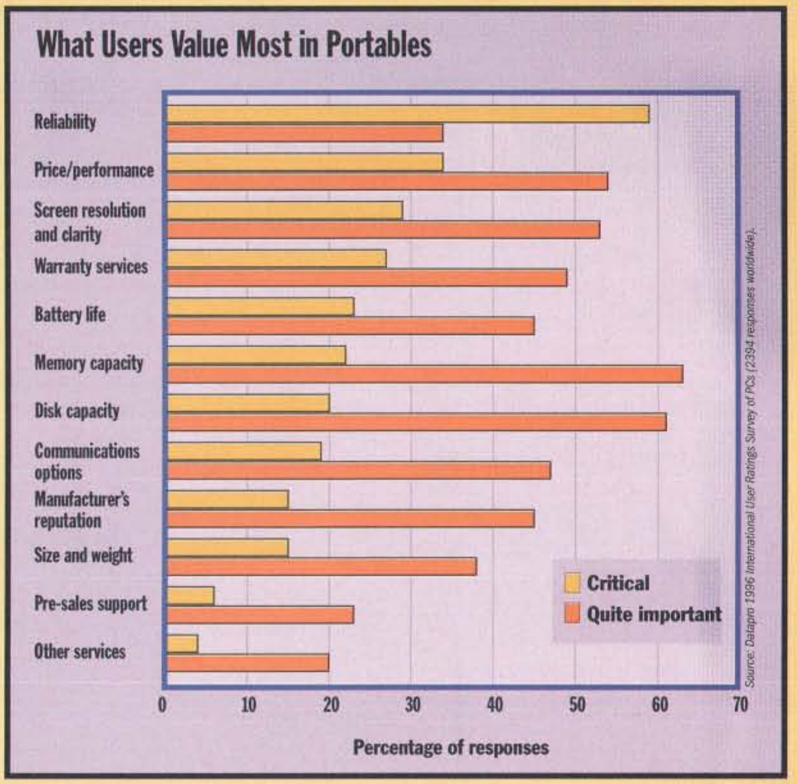
Parts of Active Server, such as DCOM, MTS, and Active Server Pages, were already shipping at the time of the announcement. Microsoft Message Queue will be released this year. MTS, which was code-named Viper, is perhaps the most important of the Active Server technologies, and its initial price of $2000 is well below what competitors have typically charged for this kind of software. According to the Gartner Group's Roy Schulte, MTS has "a better-than-even chance of becoming the leading infrastructure for new enterprise TP applications by 2001, assuming the role that CICS has played during the past 20 years."

MTS has limitations. In its first release, for example, the product is entirely focused on Windows NT and Microsoft's SQL Server. Microsoft says that it plans to add support later this year for other databases via the Open Group's XA protocol and for a connection to CICS through a technology code-named Cedar. Support for these other transaction-processing protocols will let businesses deploy applications that integrate with Unix and mainframe systems. However, with MTS and Active Server, Microsoft has begun the foundation to allow NT to become the MVS of the client/server era. **–David Chappell**

Datapro Report

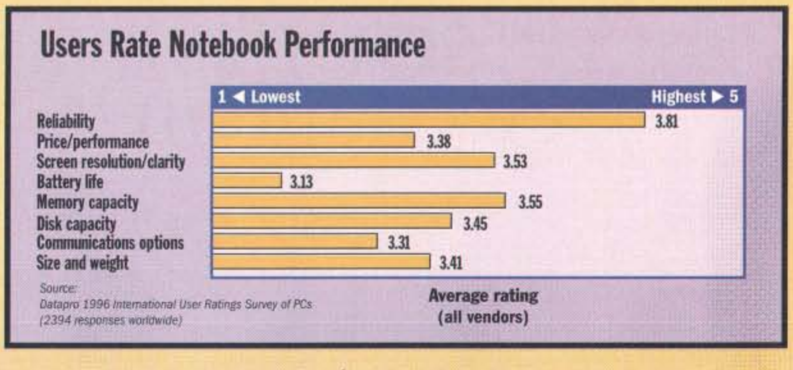
Wanted: More Powerful Mobile Systems

More power and performance are the main improvements needed to accelerate business's adoption of portable computers, according to Datapro's 1996 International User Ratings Survey of PCs. Although users place the highest emphasis on reliability when evaluating a notebook vendor, the next most important criteria are price/performance and screen resolution and clarity. However, when asked to rank their satisfaction with current portables in several categories, price/performance ranked only sixth out of eight. The poor showing of price/performance isn't surprising. Portables have traditionally lagged their desktop counterparts in overall performance, largely due to less powerful processors. **John MacGilvary**, *chief analyst, Worldwide PC Industry. For more information on Datapro reports, call (609) 764-0100; fax: (609) 764-2814; or http://www.datapro.com.*



Source: Datapro 1996 International User Ratings Survey of PCs (2394 responses worldwide).

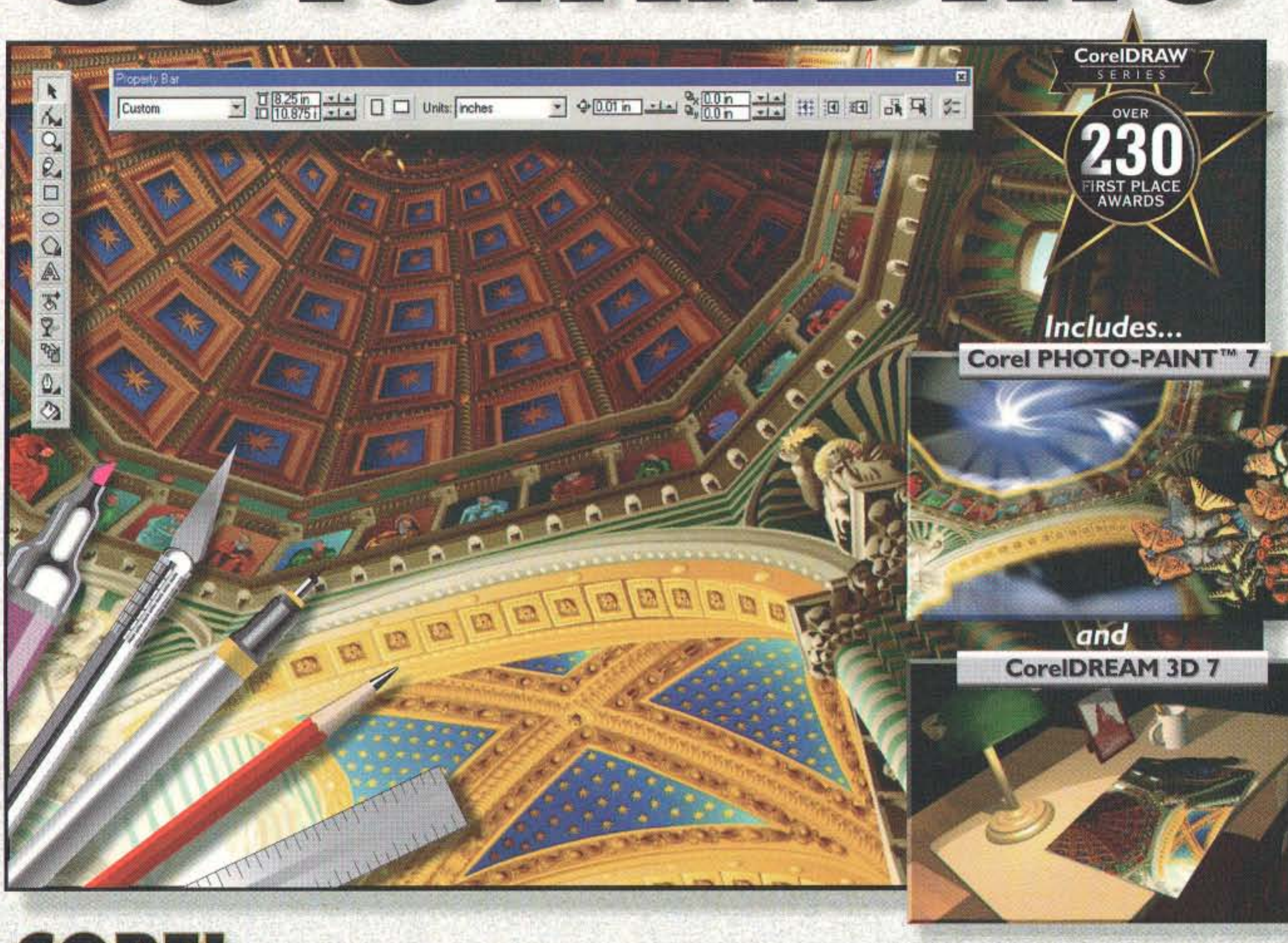
Users value notebook reliability the most.



Source:
Datapro 1996 International User Ratings Survey of PCs (2394 responses worldwide)

Users gave notebook price/performance a relatively low rating.

Simply OUTSTANDING



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Circle 134
on Inquiry Card.

cd-rom review

Who's on First?

Ah, spring is here. Can baseball be far behind? Little League baseball is played by 2.8 million boys and girls in over 90 countries. By compiling Know Your Baseball, a CD-ROM that teaches the rules and skills that make up the game, Axia Multimedia provides a much-needed reference guide.

Using visual displays, audio, dramatizations, and real-life footage, the producers of Know Your Baseball offer instruction in the fundamentals of almost every aspect of the game, from bunting to stealing bases to fielding a fly ball. Once you've selected which element of the game you want to work on, you can learn in several ways, such as listening to the advice of assorted coaches, viewing diagrams of where players should position themselves on certain plays, or watching video of how you should perform a play or action. Players and coaches alike will improve their skills with this CD-ROM.

Know Your Baseball provides an excellent guide to baseball.

However successful this CD-ROM may be in teaching aspiring young ballplayers about the fundamentals of the game, it obviously can't substitute for playing the game, especially when it comes to teaching about sportsmanship. Many sections of the CD-ROM provide lessons on how to apply honesty and sportsmanship to baseball, and how that will carry forward to real life. However, a young boy or girl is not going to learn about honesty and sportsmanship by sitting in front of a computer alone. One of the best places to learn these qualities is on the baseball field. **–Jesse Friedman**

Know Your Baseball, Axia Multimedia
Corp., Calgary, Alberta, Canada
(403) 258-5870; fax: (403) 258-5871
$35

Advances and Retreats in Computing

C++ for Ebonics?

Should everyone, even programmers, be allowed to have their own dialect? Recently, the Oakland, California, school board declared that one particular dialect of English spoken by African Americans and called Ebonics had become so common that it is now a distinct language and can be taught as an alternative to Standard English. But the basic question—whether a dialect should be officially allowed to replace the gold-standard version of our mother tongue—is not new. During the past decade, a dialect called C++ rose to prominence among the hacker-American community. Educators (or teachers, as they are known in some circles) and parents have debated whether to use it, honor it, or kill it.

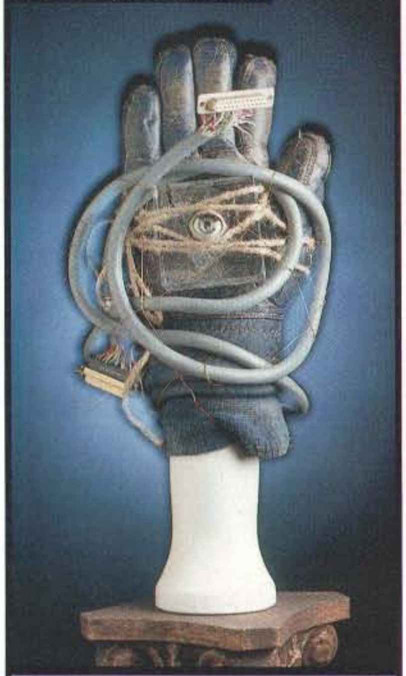
For many years now, school boards across the country have been asked to introduce C++ into their curricula. Supporters say that this is a good thing, that many students now come from households where C++ is a primary means of communication, that literacy is literacy no matter what the language.

Critics say that the prevalence of C++ in homes is really and simply a symbol of widespread family dysfunction. To these critics, C++ fluency is not something to be proud of. The dialect is so much a corruption of basic English, they insist, that those who use it flaunt their rebelliousness even in such trivial ways as spelling the name C++ with plus signs rather than alphabetic characters. The critics compare this alpha-symbolic moniker, often sneeringly, with what they term the "offensive show-off-iness" of the singer who changed his name from Prince to symbols that are practically unprintable.

So should C++ be accepted in schools as an alternative to Standard English? If you have an opinion, please e-mail us. Please send your messages in Standard English, without uuencoding.

Marc Abrahams is the editor of The Annals of Improbable Research. *You can reach him at* **marca@improb.com.**

new product



New Hand-Held Optical Scanner

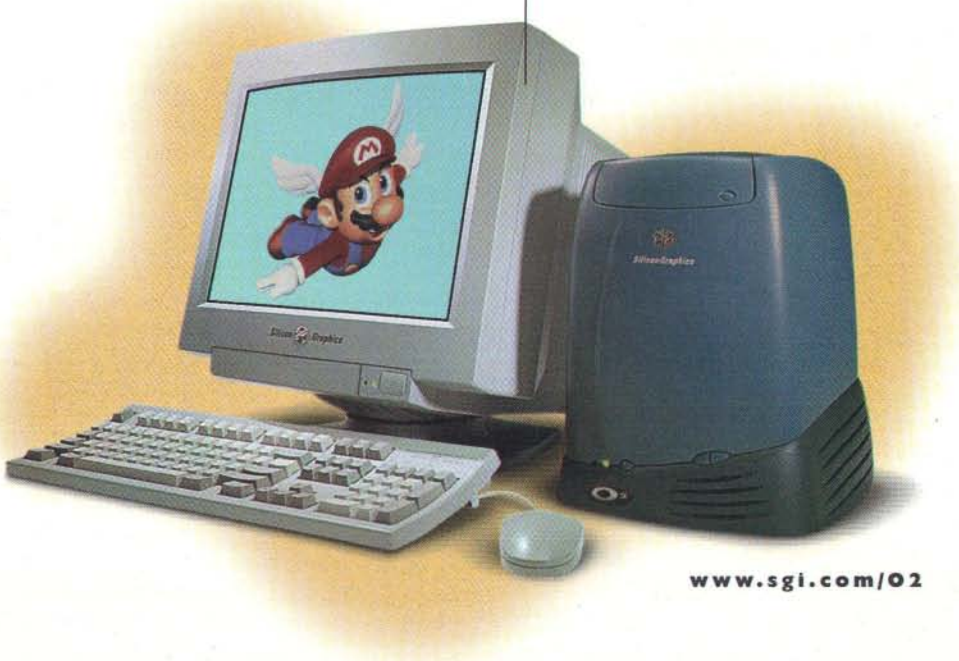
The hand-held optical scanner is a device whose time has come, and gone, and come again. The cable/connector assembly is of advanced generic design. The eyeball mechanism and plastic optic-mounting complex is patent permanently pending, and the eyeball itself is in a state of perpetually suspended animation. The version shown here is the single-glove, or Jackson/Simpson, model. A double-glove model features a very large, fiber-optically hairy eyeball that wanders. The eyeballs are of uncertain origin. The alpha and beta versions of the scanner use all-synthetic optical materials. The production models will feature biologic and bioreengineered components. The design is not approved by People for the Ethical Treatment of Animals.

The benefits of the hand-held optical scanner are not immediately obvious, which is why the advanced marketing modules are so valuable. The glove (or, in the double-glove version, gloves) is (or are) removable.

We are interested in receiving image files that you have produced with the hand-held optical scanner. If you have an image that would be of interest to our readers, please send it to marca@improb.com.

PHOTOGRAPH: BRIAN WILDER © 1997

Oh, my.



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Blasts from the Past

5 Years ago in BYTE

Seven out of nine portables capable of running Windows in a review used the 386SX/20 processor (the other two used the 486SX/20 and the 386SL/25). With its new PowerBooks, Apple reentered the portable market with a vengeance. Other reviews included looks at spreadsheets and memory managers for MS-DOS.

10 Years ago in BYTE

We liked Borland's Turbo Basic, which provided better support for Intel's 8087 numeric coprocessor than Microsoft's Basic. Among several stories on image processing was one that discussed its use at NASA's Jet Propulsion Laboratory. The 286-based AT clones we reviewed cost as much as $3995.

15 Years ago in BYTE

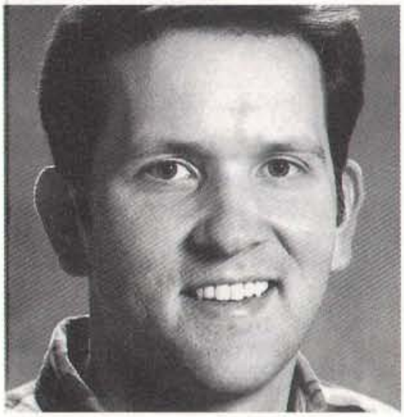
The new $895 Smith-Corona TP-1 daisy-wheel printer (average speed about 12 characters per second) and other printers heralded a new era of affordable word processing computer systems. We reviewed games in BYTE's Arcade section.

20 Years ago in BYTE

We continued our tutorial on the digital-cassette subsystem. Another article discussed how you can use computers to direct radio-controlled airplane motors and other engines. The idea was to build your own robot.

Zero Admin Windows

Victor Raisys, lead product manager of systems management products, discusses how Microsoft will make PC management easier.



BYTE: *What is Zero Administration for Windows, and how will it help end users and network administrators?*

Raisys: Zero Administration for Windows (ZAW) is an initiative from Microsoft to reduce overall PC costs and give information-technology professionals new levels of control and manageability over the Windows-based environment that they manage. The ZAW initiative will enable automatic system and application updates. For example, any available updates to the OS and applications will be automatically and seamlessly loaded and made available for the end user without the need for the administrator to intervene.

In addition, increasingly we have users who aren't tied down to a specific PC within an organization. They move from PC to PC. The ZAW initiative will also further enable users to move throughout the organization and have the information that they need follow them regardless of their physical location.

The ZAW initiative will also let administrators more easily manage their systems from a central location. We give administrators the ability to centrally manage systems today, but this is largely a manual task. ZAW will let administrators set a policy and let the OS administer that policy.

All of that combined is designed to bring down the needless costs for administration.

BYTE: *What are the main pieces of ZAW, and when are they expected to become available?*

Raisys: The ZAW initiative is designed to be available with the Windows NT 5.0 and Memphis OSes. [Editor's note: *At press time, Microsoft slated the second half of 1997 for release of both OSes.*] It's a little early to go into the details of the implementation, but components of the initiative will go into the next version of NT and will include things like the Active Directory (Microsoft's forthcoming advanced directory service), Windows Scripting Host, enhanced setup technologies, the Microsoft Management Console, and other technologies in the OS. It will also include products already available, such as Microsoft's Systems Management Server.

BYTE: *Is the goal of ZAW truly Zero Administration, or should it be more accurately described as "lowered administration"?*

Raisys: It's both of them. We can bring the administration of certain everyday management tasks like distribution of software upgrades and application updates down to zero. Once an administrator specifies the desired state of the desktop, no additional administration will be needed to maintain that state of the desktop.

But there will always be administration costs and administrative tasks associated with management, depending on an organization. Zero Administration frees up administrators to focus on the tasks that they really need to spend time on, such as supporting their end users or spending more time planning the infrastructure.

BYTE: *Will ZAW provide any benefits to customers using existing technology?*

Raisys: The basic concepts of ZAW will work with any client, though we hope to introduce more advanced management features into future clients and applications.

PHOTOGRAPH: MICHAEL MOORE © 1997

BYTE EXTRA

INTERNATIONAL

What's Hot at CeBIT

Telecommunications, new Java security, and hand-held PCs. *Page 40IS 3*

Windows CE Hand-Held PCs Add GSM

Wireless communications links now standard. *Page 40IS 4*

Parallel Applications

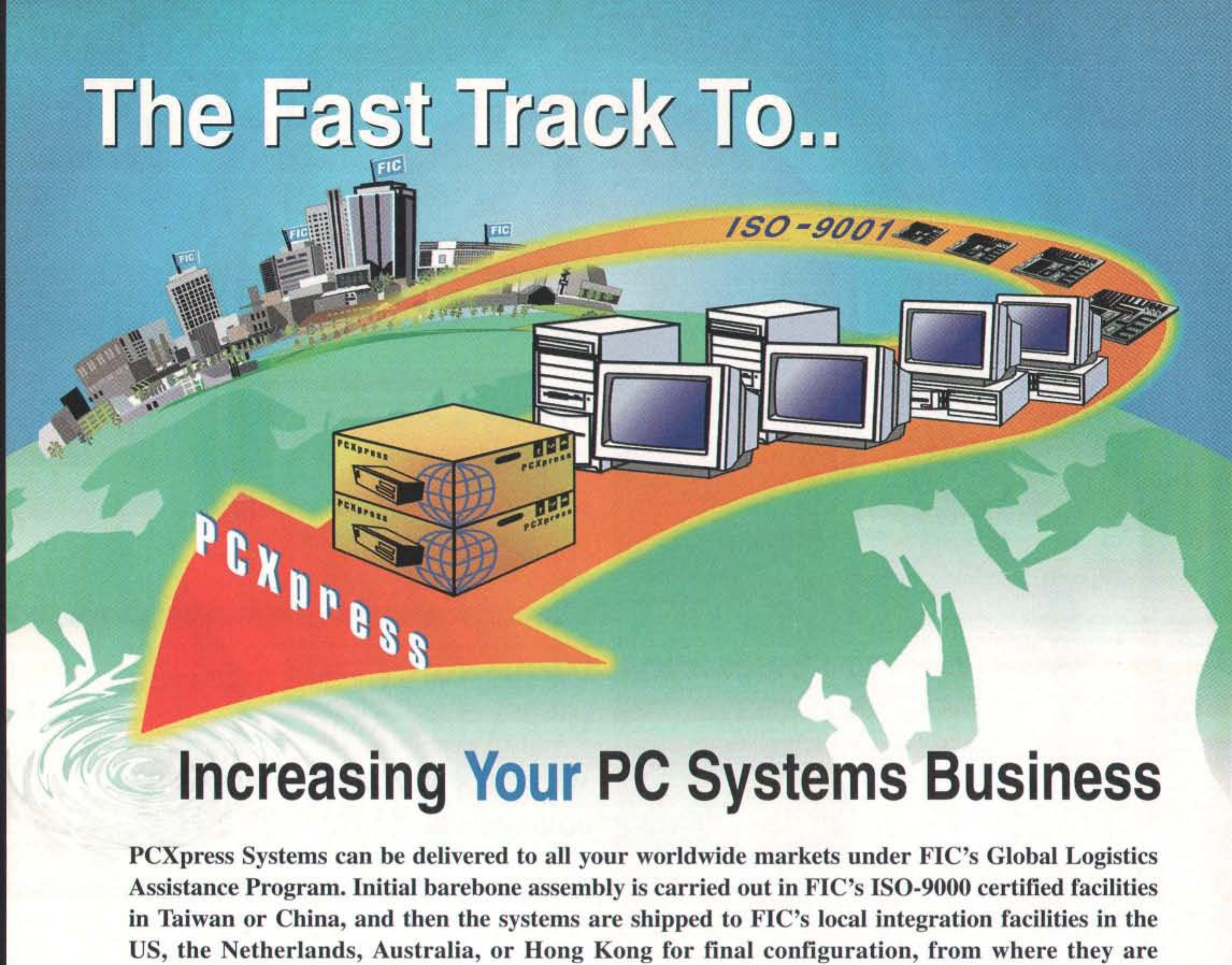
Industrial programs are key to making parallel computing popular. *Page 40IS 9*

Truthful Color

New color management technology. *Page 40IS 17*

LCDs Move to the Desktop

Bigger screen sizes and lower prices. *Page 40IS 27*



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Circle 733 on Inquiry Card (RESELLERS: 734).

What's Hot at CeBIT 97

New Java security, Unified Modeling Language, and hand-held computers are just some of what's to be unveiled.

The world's biggest computer show is getting bigger. CeBIT 97 in Hannover will have over 6800 exhibitors spread over 350,000 square meters, a 5 percent increase over last year, according to show officials. International exhibitors are also attending the show in record numbers: of the 2700 exhibitors (40 percent of the show total) without a German subsidiary, 500 come from the U.S., 400 fly in from Taiwan, and 280 originate in the U.K.

Look for some innovative products and technologies in the following areas: intranets, telecommunications, Smart Cards, digital videodisc (DVD), Unified Modeling Language (UML), universal serial bus (USB), FireWire, and Fibre Channel. The show will also feature more mature versions of platform-independent, low-cost network computers (NCs).

Telecommunications Explosion

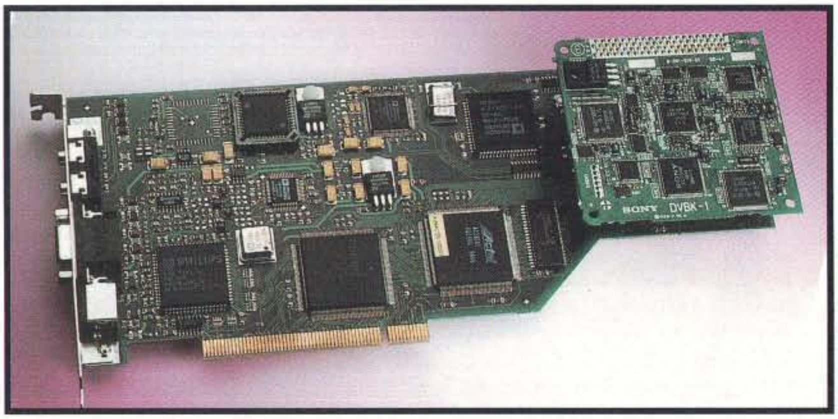
In anticipation of a more liberalized European telecommunications market in 1998, producers and distributors are expecting a boom in equipment sales. Telecommunications exhibits will occupy six halls (14, 15, 16, 17, 26 and 27) dedicated to the linkage of regional and city networks, as well as to corporate WANs over ISDN, ATM, cable TV, digital subscriber lines, cellular radio, and satellite systems.

RAD Data Communications (Tel Aviv, Israel), for example, will display its new E1 access system for city networks as well as its LRS-12 modem hub, which enables the combination of high-bit-rate digital subscriber line (HDSL) and fiber-optic modems. The company's new FOMi-E1/T1 line of fiber-optic modems features sophisticated in-band management and support for SNMP.

Taiwanese modem manufacturer E-Tech will announce a line of 56-Kbps modems, as well as the CyberBullet cable-TV modem, which is based on the company's own bandwidth-sharing method.

http:// www.byte.com/

To find out how a certain kind of Unix is entering the corporate world, read "Linux in a Gray Flannel Suit" on-line.



Fast Multimedia's new FireWire video-editing board, the DV Master.

The enormous popularity of ISDN in Europe is the propelling force behind many new products. At the workstation level, companies such as AVM, Elsa, and Eicon.Diehl are developing more robust communications solutions for Windows 95 and NT 4.0. "The market is demanding mature ISDN drivers for workstations running NT; that's part of our focus for this year's CeBIT," says Uwe Scholz, corporate communications manager with AVM (Berlin, Germany). The company's NTi Tuning Kit for ISDN has a collection of 32-bit NT drivers for passive ISDN boards supporting Common API (CAPI) 2.0 as well as Microsoft's NDIS/WAN Miniport API.

Elsa (Aachen, Germany) extends its family of ISDN boards with the high-end Quickstep 3000, which includes ISDN as well as an analog modem chip on-board.

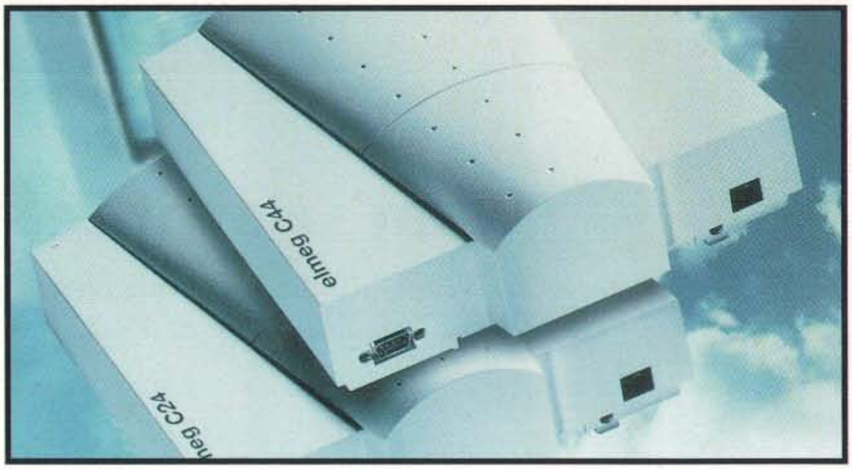
Similarly, Eicon.Diehl's (Leonberg, Germany) new range of Diva 2.0 ISDN boards now includes the Diva Pro 2.0 program, which also supports analog communications. Diva Pro 2.0 will be available in both PCI and PC Card versions.

With its SwissMod family of ISDN terminal adapters, Telelink (Cham, Switzerland) goes one step further. The latest versions of this product line are now based on what the company refers to as a *superhybrid architecture*: They feature ISDN as well as a modem socket in the same case. By linking the SwissMod to the ISDN socket, you can transfer files or remotely access a LAN or the Internet over ISDN. With another cord that you plug into the SwissMod analog socket, you can run the same application over the telephone network.

continued

Telelink's Cardline Twin PC Card also has ISDN and telephone sockets on-board. But the latest version of the card has an onboard interface for the Global System for Mobile Communications (GSM) network. Thus, no matter what type of network is available, the new Cardline Twin cards ensure that your mobile computer can be hooked to your corporate network.

An interesting development comes from the German telecommunications equipment manufacturer Elmeg (Peine). The company will introduce a new range of its TAPI–enabled ISDN switches. These switches enable you to use standard analog phone and fax equipment with ISDN devices. A small office user, for example, can program his or her PC to direct calls from a certain postal-code area to one of the switches' eight extensions.



Elmeg's TAPI–enabled ISDN switch brings call–center features to the home office.

For larger call centers, Siemens Nixdorf (Munich, Germany) has developed a comprehensive and easy-to-use telephony interface. SimplyPhone supports call forwarding and conference calls via drag and drop and integrates with all MAPI and TAPI applications, as well as with X.500 directory services.

Other show highlights from Siemens include a groupware-enabled PC desktop administration tool, called Desk 97, that lets users adjust standard office applications to their needs. Desk 97, the company's Enterprise Middleware Framework (EMF), and other Siemens applications now all integrate with Community, the company's software-component and client/server architecture for Windows.

USB Peripherals

The USB architecture promises to make it easier to connect peripherals to PCs. CeBIT will offer many USB-enabled keyboards, including one from Cherry (Auerbach, Germany); monitors; loudspeakers; and sound boards. Also featured will be a group of new PCs that support USB, including Siemens-Nixdorf's new Scenic PT 5xx systems.

One of USB's limits is that it cannot handle uncompressed live video, such as what's needed for MPEG-2 and DVD data streams. The IEEE-1394 FireWire bus standard was devised to handle requirements for higher throughput.

New FireWire video-editing solutions now come from companies such as Fast Multimedia (Munich, Germany) and miro (Braunschweig, Germany). Fast's DV Master and the miroVideo DV100 both deploy a codec chip for Sony's Digital Video format that, together with the high data transfer rates of the FireWire bus (up to 200 Mbps), enables high-quality real-time video editing.

The miroVideo DV100 ships with the company's StoryTools nonlinear editing software, which allows for the development of storyboards via drag and drop. For Fast Multimedia's video-editing boards, Russian software publisher AIST has developed a new version of its MediaMania Broadcast animation and compositing program. MediaMania BroadcastVM 2.0 supports morphing, ghosting, and professional color keying. Ulead Systems (Taipei, Taiwan) will showcase at CeBIT a new version of its popular MediaStudio Pro video-editing software package. Version 3.0 makes more effective use of system resources, resulting in higher rendering speeds.

continued

Hand-Helds Get GSM Connection

Hand-held computers, pocket organizers, and PDAs running the stripped-down 32-bit Windows CE OS will all be on display in the CeBIT exhibition halls. Systems from companies such as Compaq, LG Electronics, NEC, and Philips made their debut late last year. CeBIT will feature a number of localized versions of these gadgets that include wireless connectivity for the European Global System for Mobile Communications (GSM) network.

Philips' Windows CE unit connects to the GSM wireless network.

For example, the U.S. model of the Philips Velo includes a 19.2-Kbps software fax modem for use with the telephone network. In Europe, however, Philips replaces the wire-line connectivity with a GSM wireless link.

Instead of providing connectivity for notebooks and other PDAs via a PC Card, the Velo uses a high-speed (230-Kbps) serial port and a special cable that links directly to the GSM phone, thereby reducing the price and power requirements of the PC Card solution. Only Philips's own mobile phones will be supported at first. Although the Velo supports PC Cards for digital cameras, business-card scanners, and vertical solutions via a snap-on module, it processes the modem functionality in software running on a Mips R3000 RISC core.

Because of the Velo's two powerful communications and multimedia chips, which can handle many telecommunications protocols, including ADSI, DECT, and ISDN, we may soon see a Windows CE PDA that includes a mobile phone. This combination will undoubtedly give Nokia's 9000 communicator some serious competition to contend with.

–Bob Emmerson

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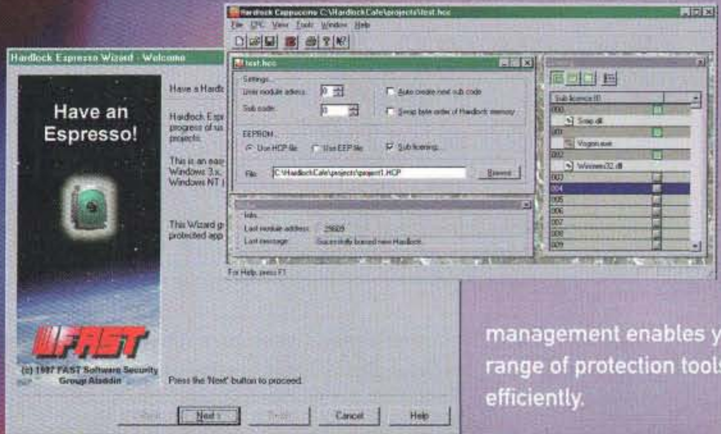

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Circle 709 on Inquiry Card (RESELLERS: 710).

Support for Microsoft's ActiveMovie and Direct3D APIs is an important feature of Scala's (Oslo, Norway) new MM200 multimedia authoring software. One of the most significant enhancements of the MM200 over the previous version, the MM100, is real-time antialiasing of fonts, according to Gilles Bourdin of Scala's German subsidiary.

At last year's show, a large number of Java development tools made their debut. This year, Java security solutions that defend corporate networks against hostile applets are becoming extremely important. Start-up company Finjan Software (Netanya, Israel), for example, has developed SurfinGate, a program that shields a single desktop or a network against applets that could violate security requirements or the integrity of the Java virtual-machine environment.

New CASE Tools

CeBIT 97 will be the first big show to offer a multitude of CASE tools that support UML, a unification of the Booch, Objectory, and OMT methods that's widely seen as the standard poised to supersede the many object-oriented design-and-analysis methods currently on the market.

Examples of UML-compliant tools at CeBIT include version 5.0 of MID's (Nuremberg, Germany) Innovator Object Workbench (IOW) and Innovative Software's (Frankfurt, Germany) Object Engineering Workbench (OEW) for C++ and Java 3.0. IOW is an integrated CASE development environment that includes a complete software life-cycle scheme and supports team development over WANs. In addition to UML support, version 5.0 of the program offers a class-hierarchy browser, version management, and an internal mail function.

By supporting UML and a new repository architecture for team development, the OEW 3.0 visual programming environment now classifies as a fully fledged CASE tool. It comes in two versions, one for C++ and one for Java. The Java version also includes a decompiler that can reverse-engineer compiled Java byte code into source code.

Another innovation making its show debut at CeBIT that many Web-site programmers will enjoy is the heitml programming language, developed by H.E.I. (Mannheim, Germany), a spin-off company of the University of Karlsruhe. Version 1.0 of the language is a combined document-description, template-generation, and scripting language for Web publishing. It has a syntax similar to that of Hypertext Markup Language (HTML) that was specially created for database applications. It was designed as an extension of HTML and, because it closely integrates with SQL and doesn't depend on other scripting languages, it facilitates direct access of a database from a Web application.

CeBIT attendees will also witness the return of Commodore (Nieuw-Vennep, The Netherlands). The company will show a series of new multimedia consumer PCs—among them the P166 UltraMedia—based on Intel's MMX processor technology. **B**

BYTE's Best of CeBIT Awards

Some of 1997's hottest products will be announced at this year's CeBIT. To recognize innovative companies that are advancing the state of the art in computing and communications, BYTE will again present the Best of CeBIT awards in a special ceremony scheduled for Monday, March 17, in the following categories:

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Rainer Mauth is a BYTE senior editor based in Frankfurt. Also contributing to this article was Valerie Thompson, a freelance writer based in Zürich, Switzerland.

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News & Views

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For Business Applications

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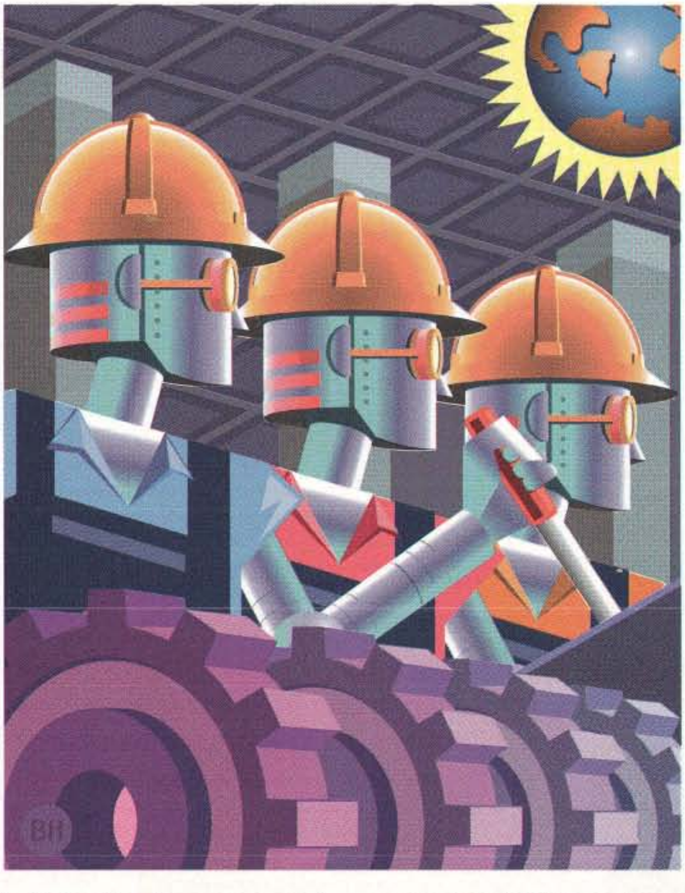
Mainstreaming Parallel Computing

Lack of industrial applications inhibits parallel computing's growth.

By Dick Pountain

Massively parallel supercomputers are indispensable tools in academic research, but they haven't driven considerable inroads into the realm of industrial applications. Why? A group of European software developers and organizations from various industrial sectors, sponsored by the European Union's ESPRIT program, believes the reason is the lack of commercial applications to run on these super-fast behemoths.



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The face of massively parallel computing has changed dramatically over recent years. You can now buy reliable parallel hardware "off the shelf" from vendors like IBM, Meiko, and Parsytec at a fraction of the price of traditional supercomputers. These parallel machines are built from commodity RISC microprocessors like the PowerPC or SPARC instead of expensive custom chips. However, program code tends not to be portable between different parallel architectures, and this has led to a vicious circle: A lack of commercial software stifles machine sales, and software vendors don't port their code to parallel machines because the market is too small. Parallel computers have stayed stuck in research laboratories, which normally write and maintain their own software anyway. That's why parallel computers have failed to really penetrate the industrial sector, where users expect a reasonable amount of service and technical support.

Europort, a European Commission-funded project that started in 1994, addresses this vicious circle by porting widely used industrial-design applications to a variety of parallel computers. The results of the first two project phases, Europort 1 and Europort 2, which ended late last year, are encouraging. They have shown that the performance increases more than justify the cost and effort of porting.

This parallelization initiative has given a much needed boost to the European software industry. "Although U.S. firms may lead in building parallel hardware, they are failing to exploit it with effective software," says Dr. Stephen Brindle of Smith System Engineering, one of the managers of the Europort project. "Thanks to Europort, we in Europe are now ahead in creating commercial parallel applications."

Europort's reference platforms include symmetrical multiprocessor systems, distributed-memory (massively parallel) multicomputers, and networks of RISC workstations. The 30 Europort consortia ambitiously aimed to port 38 industrial applications to at least two of the hardware reference platforms. Though the majority of these applications fall within the traditional high-performance computing provinces of mechanical engineering, fluid dynamics, and computational chemistry, the more unusual applications included cartoon animation, simulation of traffic flow, and radiation therapy simulation.

All Europort projects worked with the message-passing programming paradigm, which describes the cooperation of different processors without shared memory by exchange of messages on some sort of channel (e.g., FDDI, transputer links, Ethernet). These message-passing processes were implemented via the portable parallel code libraries PVM, PARMACS, and MPI.

PVM (for Parallel Virtual Machine), a public-domain library of message-passing primitives, enables a heterogeneous network

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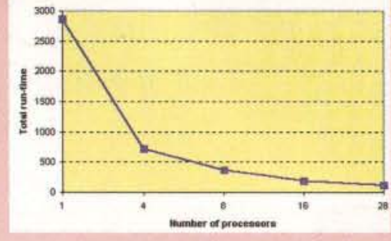
Europort Benchmarking

Europort created a benchmarking process designed to compare code scalability across different parallel architectures and for different problem sizes. Every application was benchmarked on at least two reference platforms with three different data sets. The testers ran these codes on each platform using progressively increasing numbers of nodes so as to assess the scalability of the code and estimate its parallel efficiency.

The benchmark graphs are usually flattening curves, showing that parallel efficiency generally falls off as you add more processors, until you reach a point where the extra speedup is not worth the cost of adding more CPUs. That's the sort of economic calculation that benchmarking makes easier.

Number of Processors	Total Run-time (secs)	Speedup
1	2855	1.0
4	714	4.0
8	358	8.0
16	184	15.5
28	109	26.2

Medium problem (whale sperm myoglobin) on IBM SP2



Test measures parallel efficiency of MaxHom application on up to 28 CPUs.

The Europort hardware reference platforms are:

- **IBM SP2 (128 and 28 nodes)**
- **Meiko CS-2 (32 nodes)**
- **Parsytec GC PowerPlus (64 nodes)**
- **Silicon Graphics PowerChallenge Array (64 nodes)**
- **DEC Alpha "farm" (eight nodes)**

of workstations to simulate a single parallel computer. There are implementations of PVM for most flavors of Unix, for OS/2, and now for Windows, too (see "Parallel Computing Windows Style" May '96 BYTE). PARMACS (for PARallel MACroS) was originally implemented as FORTRAN 77 macros and is now, in version 6.0, also available to C and C++ programs. The Message Passing Interface (MPI) is emerging as a standard that's being promoted by the main U.S. vendors of parallel hardware. These libraries include node process creation and synchronous and asynchronous communications. They enable programs to communicate between different types of processors, which may even be running different operating systems. By providing a hardware-independent message-passing interface, such libraries allow the same piece of parallelized code to run on each of the Europort reference architectures.

A major attraction of these API libraries is that programmers can call them from the standard programming languages used in the industrial computing world, notably FORTRAN 77, FORTRAN 90, C, and C++, so that no unfamiliar languages need be introduced. (The exception was the LP2-Erlang consortium, which ported the parallel functional language Erlang, used to program and simulate large telecommunications networks.)

The Downside: Parallel Software Flaws

Europort was not always a pleasant meeting of parallels. Some developers described the PVM (Parallel Virtual Machine) message-passing library as unstable and unreliable. Other developers felt release updates were issued too frequently. Several consortia reported that PVM didn't fully support C++ features on some platforms, so they had to spend time programming around missing functions.

Most of the programmers reported that the debugging facilities on the parallel reference platforms were in general unstable and inadequate; that the documentation was poor; program initialization procedures were tricky and inconsistent between platforms; and that it was hard to extract useful machine load information. Many also experienced implementation conflicts between versions of FORTRAN, MPI, C, and C++ for the various platforms.

No Magic Bullet

Although parallel programming research has worked on it for years, there is no

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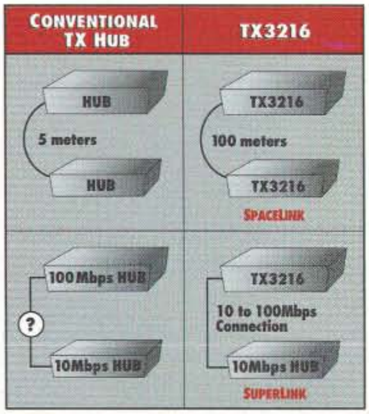

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"magic bullet" procedure for porting serial applications to a parallel platform. Each Europort consortium had to study the structure of serial algorithms and data sets and then deduce efficient ways to decompose and run them on multiple processors.

The Europort programmers generally agreed that the adoption of generic message passing was a good idea—it saved coding time compared to using the hardware vendors' proprietary libraries. Interestingly, many of the consortia found that even on the shared-memory computing platforms, message-passing implementations of their code exhibited much better scaling behavior than native memory-sharing versions.

The difficulties of parallelization within the Europort consortia varied as widely as the application domains involved. The MaxHom team, for example, worked on 3-D modeling software for protein design and was able to adopt a coarse-grained parallel implementation with relatively small changes to the serial code and using very limited interprocessor communication. This kind of coarse-grained single-program, multiple-data (SPMD) approach proved to be successful for other consortia, too, and it was often implemented using a master-slave paradigm where a single process spawns child processes onto separate processors at run time. Each child process performs part of the calculation and then passes it back to the parent for consolidation into the final result. This technique makes initializing and launching the application much simpler, as it involves loading only one node, and all output takes place through a single node.

Step-by-Step Approach

The Free University of Amsterdam used this technique to parallelize its ADF (Amsterdam Density Functional) program, which is used by chemists for predicting molecular structure. The first prototype of the program loaded each node with the same code and the same data, so that the nodes all duplicated each others' work and the program remained a serial one. The programmers then gradually introduced more parallelism and reduced the serial part by partitioning the data onto the different CPUs.

This step-by-step approach meant there was always a running version of the code. In the words of the programmers' report, "this not only made debugging much easier, but also the determination of the most time-consuming serial parts that still remained to be parallelized." Another advantage is that the structure of the parallel program is virtually identical to the structure of the serial program. Because of these similarities, it is much easier to maintain and extend the functionality of the parallel and serial versions simultaneously.

In some cases the effort of parallelization even caused the programmers to examine and improve the algorithms employed in the original code. For example, the LINPARC2-Traffic consortium ported a traffic-flow simulation application and found that its version of the algorithm showed poor convergence behavior when parallelized. However, the programmers rewrote the main algorithm

Europort Projects at a Glance

The 38 Europort porting projects straddled a fairly wide range of application areas. Here are some of the most intriguing projects.

The PEPSE (Parallel Electromagnetic Problem Solving Environment) consortium ported a program called EMA3D, which simulates the effect of external electrical influences on aircraft airframes. The end users were British Aerospace and the University of Bradford; the parallel experts were the French firms FEGS and CERFACS. EMA3D, owned by the U.S. firm Electromagnetic Applications, does its job by finding a full 3-D solution of Maxwell's curl equations, using a finite difference time domain algorithm that is very compute-intensive. Parallelizing this code achieved a 30-fold speedup on the 64-processor Parsytec GC/PP machines and a 50-fold speedup on a 128-processor IBM SP2.

The benefit: *PEPSE makes it practical for the first time to simulate the effects of a lightning strike on the whole airframe of a fighter jet.*

The Paramation consortium parallelized Cambridge Animation's Animo software. The other participants were end-user Siriol Productions and parallel experts Perihelion Distributed Software. Animo is a 2-D animation program that Siriol used to produce a cartoon feature film (which has been sold to Disney). The program performs both automatic "in-betweening" (interpolating the sequence of transitional images between two key frames) and color rendering of frames, both of which are highly labor-intensive tasks. Parallelizing the off-line rendering functions of Animo to run on clusters of DEC Alpha, Silicon Graphics, and Pentium workstations resulted in a fourfold speedup using five workstations.

Parallel Animo renders frames faster.

The benefit: *Time and cost savings for commercial animation studios.*

PAM-Crash simulates car crashes by using finite element analysis. The consortium included automakers BMW, Audi, and Hyundai, with code owner ESI. The group found that parallel PAM-Crash scaled well on up to 128 processors, where it still showed a 55-fold speedup, i.e., a parallel efficiency of around 43 percent. (Parallel efficiency is a measure of how well a hardware/software combination scales. If a program runs twice as fast on two processors as on one, its parallel efficiency would be 100 percent.) A Meiko CS-2 with eight SuperSparc nodes ran PAM-Crash faster than the Cray YMP vector processor used to run the serial code.

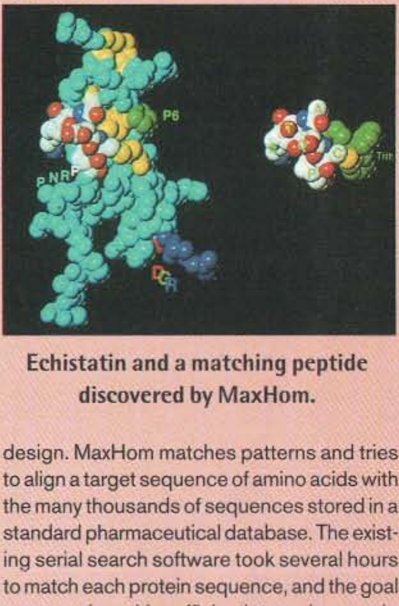
The benefit: *Cost savings through better understanding of crash behavior.*

RAPT, the RAdiotherapy Treatment Planning System, is based on a simulation library called EGS4 that's owned by EDS Systems and Management. The RAPT porting consortium included the Ospedali Galliera of Genoa and Southampton University's Parallel Applications Centre. RAPT models the radiation doses delivered during radiation therapy for tumors. It allows clinicians to develop treatment plans that are effective while minimizing consequential damage to healthy tissue.

The program builds a 3-D model of the patient's body from CT and MRI scan data and then employs Monte Carlo methods to calculate the absorbed radiation dose from any particular beam configuration. RAPT's big advantage over other prediction methods is that it doesn't assume an idealized "average" patient but works with the actual patient, so it can allow for variations in tissue density and deliver a more accurate dose prediction. The Monte Carlo algorithm, which generates millions of randomized photon trajectories, would normally need to run on a vector supercomputer, which is beyond the budget of most medical physics departments.

The benefit: *Allows hospitals to run a full body simulation in an hour or less.*

The MaxHom (Maximum Homology) consortium involved parallel computer maker Parsytec, the pharmaceutical firm E. Merck, and the European Molecular Biology Laboratory in Heidelberg. It parallelized the search software for a protein database used in modeling 3-D receptor structures for drug design. MaxHom matches patterns and tries to align a target sequence of amino acids with the many thousands of sequences stored in a standard pharmaceutical database. The existing serial search software took several hours to match each protein sequence, and the goal was to reduce this sufficiently to make searches interactive.



Echistatin and a matching peptide discovered by MaxHom.

The parallelized MaxHom code was ported to a 128-node Parsytec GC/PP, a 28-node IBM SP2, and a 64-node Silicon Graphics PowerChallenge array. In each case, the code showed a parallel efficiency of around 70 percent; the 128-node Parsytec gave a speedup of 92 times. Merck is already using parallel MaxHom for real industrial tasks, such as finding the interaction site of the snake venom protein echistatin and its receptor on a blood protein; typical search runs took about 3 minutes.

The benefit: *Makes searches in protein databases interactive.*

during parallelization, and applying this to the serial code, too, speeded it up by four to six times.

Break-Even Point

All Europort consortia achieved worthwhile performance improvements of their code through parallelization. However, according to Clemens-August Thole of GMD/SCAI, the managers of Europort 1, "The final judgment on the real economic impact of Europort can only be made two years from now." A cost/benefit analysis performed by Europort 2 management indicates that all the consortia expect to have recouped their costs by 2001, while most will be showing a profit by 1998 or 1999. A lucky few, like the owners of Animo and PAM-Crash, were already into profit before Europort was completed.

The primary benefit for Europort's code owners is that the improved performance of the code makes it easier to sell. For the code users there are several benefits. Faster code may translate directly into time and money savings, as with Animo's fivefold reduction in rendering time. But on the other hand, users can also achieve more precise results by performing more calculations in the same time, as is the case with RAPT, the RAdiotherapy Treatment Planning System that uses Monte Carlo methods.

In some cases the time saved by parallelizing software will make economically feasible a procedure considered impossible on serial computers. This is the case, for example, with PEPSE's program for analyzing lightning strikes. Perhaps most important of all in an industrial context is that parallelization enables corporations to exploit existing computer resources more effectively—for example, using the office network during the night to perform long rendering jobs.

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In many respects the biggest lesson to be learned from Europort is that sometimes it takes an outside initiative to give a kick to a market locked into a vicious circle. This lesson is sufficiently compelling that ARPA, the U.S. defense research organization, now plans to emulate Europort in the States. ARPA will adopt Europort's three-part consortium structure: owners of the application code, industrial end users, and a parallel processing expert. Most participants believe this approach was crucial to the projects' success since it kept the efforts focused on usability and commercial viability rather than on the theoretical dogmas that have plagued the parallel computer community. B

Dick Pountain is a BYTE contributing editor in London. You can reach him at **dickp@bix.com.**

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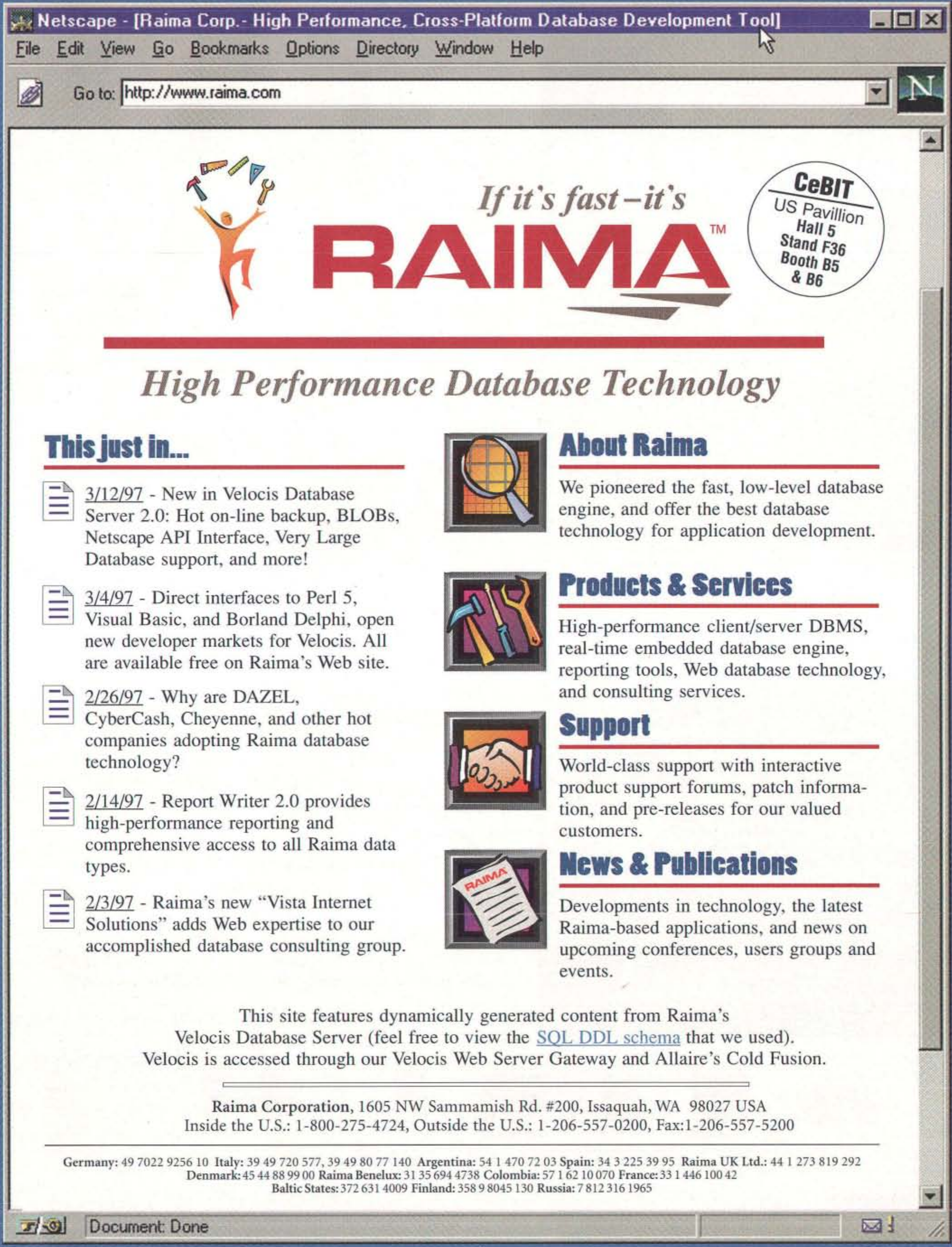
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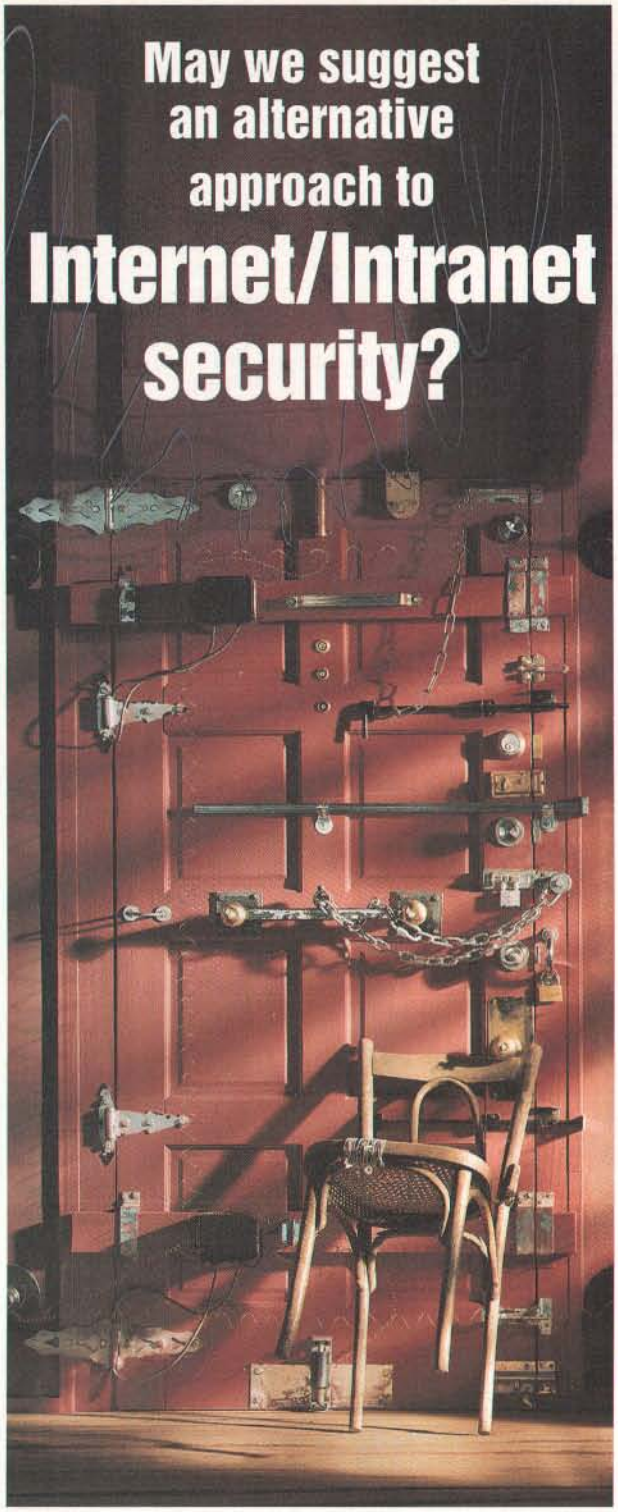

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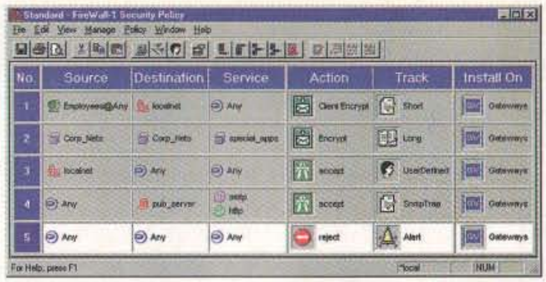
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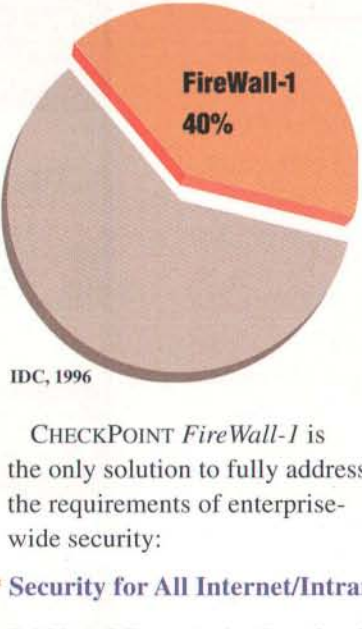

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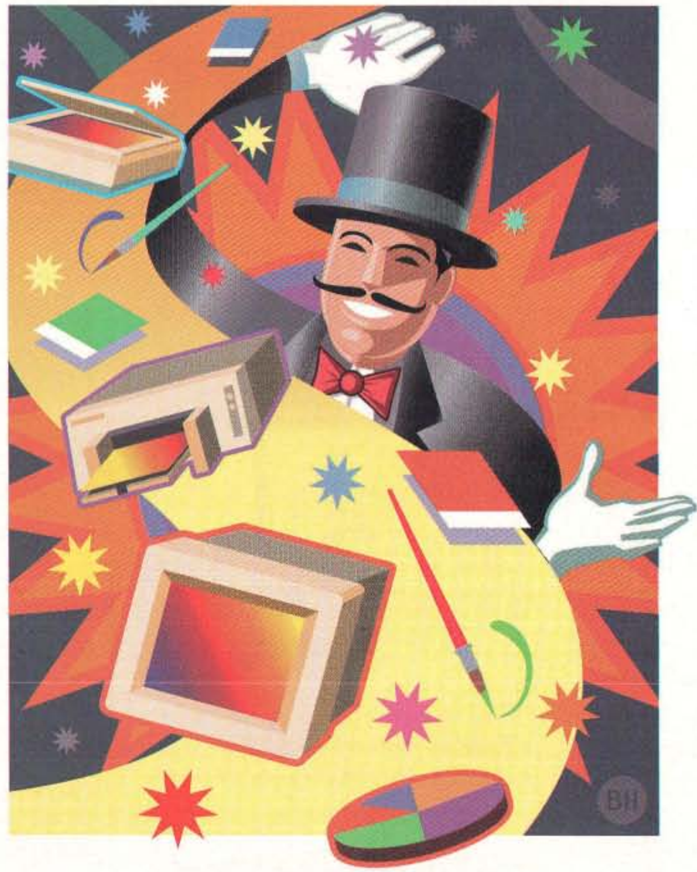
Truthful Color

New color-management techniques take desktop printing systems to the next level of quality.

By Udo Flohr

Despite all the technical achievements of recent years, color management is still a hassle for users of desktop publishing (DTP) systems. On one hand, with the standardization of device-independent color spaces, WYSIWYG for color is now possible, and the International Color Consortium's (ICC's) definition of cross-platform, device-independent profiles eliminates awkward and time-consuming recalibration. But on the other hand, carrying up to 400 KB of profile information per image file throughout the image-manipulation process is still cumbersome.



The basic problem of color management is that input and display devices, such as scanners and monitors, and output devices, such as printers and offset printing machines, work with different color models. Computer monitors create colors by mixing the light emitted by red, green, and blue phosphor coatings on the screen. Scanners also use the RGB model by measuring the amount of reflected white light that the devices' RGB filters allow to pass through.

But the same RGB color signal on two different devices normally creates two different color impressions, because RGB colors vary according to the characteristics of the hardware. For example, open the same document on a desktop machine with a CRT monitor and on a notebook with an LCD screen, and you'll see an obvious difference. Another complication is that the RGB color model doesn't cover the visible color spectrum completely.

Color printing usually employs another color scheme, called CMYK (short for cyan, magenta, yellow, and black; the letter *K* is used to stand for black rather than the letter *B* so that it won't be confused with blue). As tiny dots interspersed on paper, these four inks combine to convey the desired color tone.

CMYK colors suffer the same drawbacks as RGB colors. They vary with printer, ink, and paper characteristics. In addition, the CMYK color space is smaller than the RGB spectrum, making it even more difficult to visualize on paper what you see on the screen—let alone the richness of the color tones present in the real world.

Scanning, manipulating, and printing RGB images are all part of the routine work flow of every graphic designer working with DTP systems. Therefore, RGB values have to be matched to CMYK values so that predictable results can be obtained. Because the RGB-to-CYMK conversion results in four separate films, this process is called *separation*.

Since neither RGB nor CMYK color values are absolute but instead depend on the specific hardware used, it's impossible to define a color exactly. Identical images, processed identically but originating from two different scanners, can very likely yield slightly different color tones in print. Therefore, unless designers can refer to a hardware-independent color space, any combination of scanner and printer needs its own transformation model (known as *calibration*) based on the device's characteristics (called *profiles*).

Traditionally, color management was all about calibrating the relevant input and output devices (e.g., monitors, scanners, proof printers, and printing presses) against each other or against a reference device and then converting colors according to this calibration. This is a time-consuming and costly process that often involves trial-and-error methods. It works reasonably well as long as the devices are used in the same configuration, but today's ubiquitous use of DTP requires a more flexible solution.

This is why the ICC, an industry consortium that includes such companies as Adobe, Agfa, Apple, Kodak, Microsoft, Silicon Graphics, and Sun Microsystems, standardized a cross-plat-

ILLUSTRATION: BRAD HAMANN © 1997

form profile format for color devices in 1993. One of the ICC's most important objectives was to incorporate color-space transformation as a standard interface in the OS—the same way that, for example, standard graphics interfaces, such as Graphical Device Interface (GDI) and QuickDraw, work.

To achieve this goal, the ICC defined a Color Management Framework that standardizes the format of all types of input, output, and display-device profiles. It provides an API for different color management methods, such as Apple's ColorSync and Microsoft Windows' Image Color Matching (ICM) feature.

Device-Independent Color Spaces

In contrast to the traditional calibration method with respect to a reference device, the ICC approach is based on a device-independent color space, which is known as LAB colors. LAB colors were defined by the International Lighting Commission (CIE). This color description is very close to the color perception of the human eye. In the LAB model, an L-value stands for brightness (on a scale of 0 to 100), and the *A* and *B* coordinates define the distance of a color from a reference white point.

It's important to realize that the LAB color space is not only hardware independent but also includes all visible colors so that no colors are lost during conversion to the LAB model. Of course, some LAB colors cannot be printed due to limitations of the CMYK spectrum. Most color management solutions therefore use *gamut mapping* (see the text box "Color Talk" on page 40IS 22) to ensure that any deviations between the original colors and the CMYK colors are as small as possible.

ICC in the Movie Industry

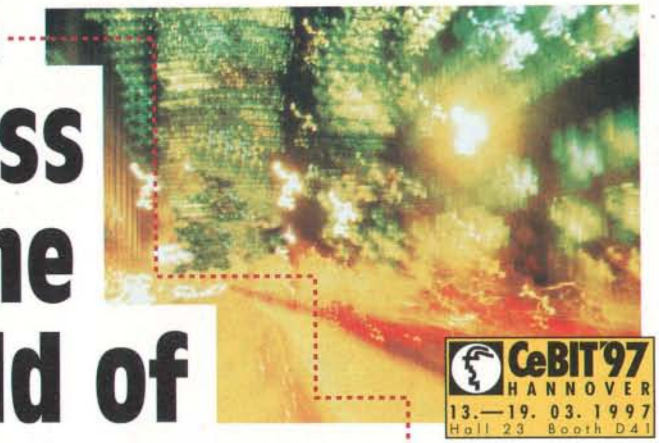
The ICC model works not just for printed images; it also works well for film and video production. Animation films are increasingly produced with computers, but without color management, obtaining the desired color on the film output is a somewhat dicey affair.

Before digital technology became a mainstay in the movie industry, color quality mainly depended on chemical and process control. As computers are used for both touch-up and special effects in live action films and for generating synthetic images for animation, the needs for video color management become very similar to those for the printing business. To complicate things further, film has a wider gamut than either display monitors or ink on paper.

In response to this problem, Silicon Graphics is currently developing the Digital Animation DreamMachine for Steven Spielberg's new studio, DreamWorks SKG, which uses device-independent, ICC-based color management. This allows output to different types of film recorders.

ICC profiles consist of a table of contents followed by tagged data. They can be embedded in TIFF, PICT, or Encapsulated PostScript (EPS) files. Profile types include input, display, and output devices, as well as profiles for color-space conversion.

Profile generation starts with colorimetric measurements of a set of colors generated from the display or printer. A scanner is usually gauged by scanning a target image with an even distribution of



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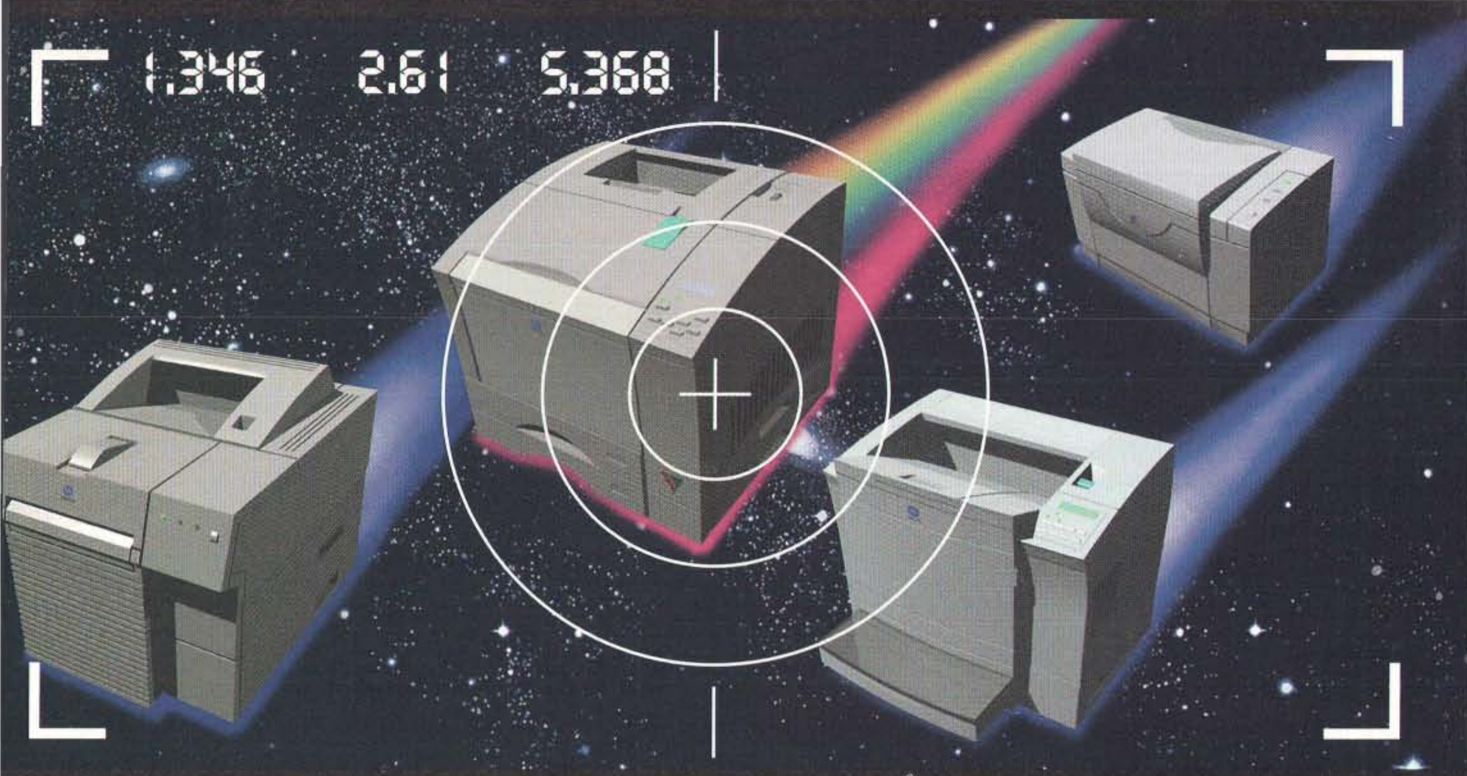

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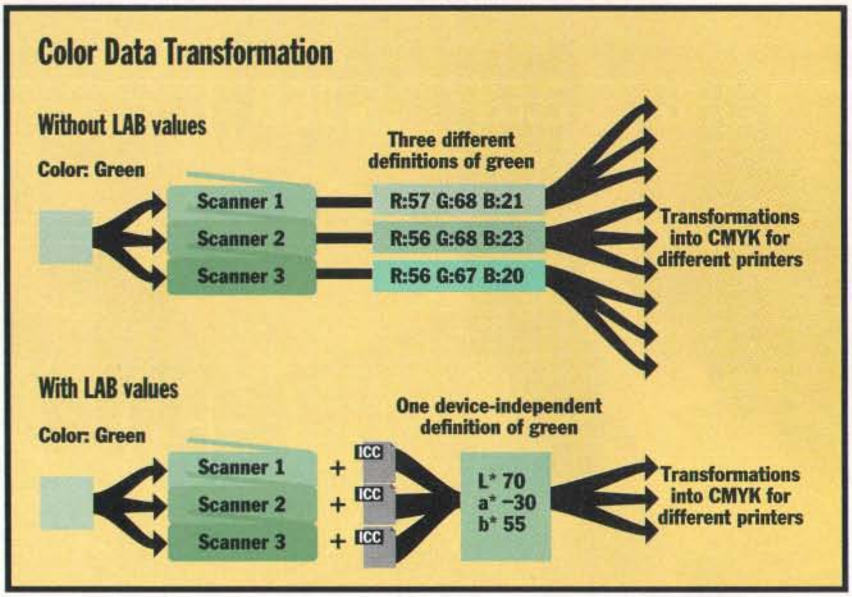
device-independent colors and then comparing it to a reference file. For a printer, on the other hand, a typical test contains approximately 210 CMYK or CMY color patches; each is read with a colorimeter and, again, compared to a set of reference color values.

A color space is a system for specifying colors; the *color value* is the unique combination of components that define a particular color. For example, the RGB color space uses three components (red, green, and blue), while CMYK uses four. RGB forms colors by adding light sources, whereas CMYK subtracts light from an illuminating source.

A scanner can usually acquire—and a monitor can usually display—more colors than the printer can reproduce. As a result, color-space conversion often involves a decision on what output colors to use to give an approximation of the input colors.

These decisions are typically based on one of two approaches. *Appearance matching* considers the subjective impression of a human viewer, and the so-called memory colors (e.g., flesh, sky, and foliage) must look acceptable to the human eye. *Colorimetric matching*, on the other hand, aims at reproducing as many colors as exactly as possible. However, compromises are inevitable. The result often does not look right to the human eye because subtle relationships between colors in an image change.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R:56 G:68 B:23
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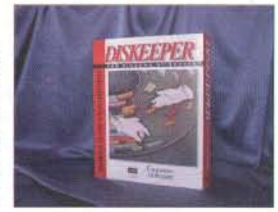

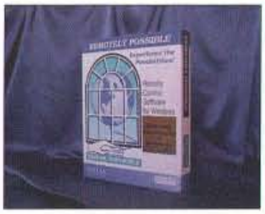

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More Flexibility

It's important to understand that this type of color management takes place for display or output only. The image from the scanner remains unchanged, but profile information is made available for the scanner. This procedure enables an ICC-compliant color management system to adjust the same image for different output media (e.g., video, film, and paper). It also allows images from several different input devices to be processed in the same document. Each image is color-adjusted separately. To achieve this flexibility, many systems embed as much as 400 KB of profile information in each image.

A new product from German software developer Helios Software, ColorSync 2 XT, avoids such overhead by managing profile information centrally. This extension works within QuarkXPress or on an Open Prepress Interface (OPI) server. It transforms colors from RGB, CMYK, and other models into device-independent LAB values and vice versa.

The tool also allows users to define LAB colors in QuarkXPress and use them

Color Talk

ColorSync
Codeveloped by Apple and Linotype-Hell, this API is part of the Mac OS and uses ICC profiles as parameters to perform color transformations.

Gamut mapping
A gamut is the range of colors that a device can produce. Gamut mapping refers to the redefining of a device's colors so that its gamut becomes more or less identical to that of another device. If, for example, you scan an image of a rain forest with more shades of green than your printer can reproduce, gamut mapping substitutes colors so that the overall impression on the human eye comes close to that of the original.

ICC
Stands for the International Color Consortium, a group of vendors who defined the ICC profile format, a cross-platform specification that allows developers to create profile tools and applications supporting the ICC profile standard. Founding ICC members include Adobe, Agfa, Apple, Kodak, Microsoft, Silicon Graphics, Sun, and Taligent.

ICM
Stands for Image Color Matching, Microsoft's color-matching standard for Windows 95. It's based on the Kodak Precision Color Management System (KPCMS).

LAB colors
In LAB colors, the L-value stands for brightness (on a scale of 0 to 100), and the A and B coordinates define the distance of a color from a reference white point. The LAB color space includes all visible colors and is device independent.

OPI
Stands for Open Prepress Interface. Facilitates the handling of print jobs with large amounts of image data. Original high-resolution images are kept on an OPI server. Layout applications can then work with small low-resolution substitutes, so the processing of material goes much faster.

Profile
A device description that contains information about how a given device—such as a scanner, monitor, or printer—mixes and reproduces colors.

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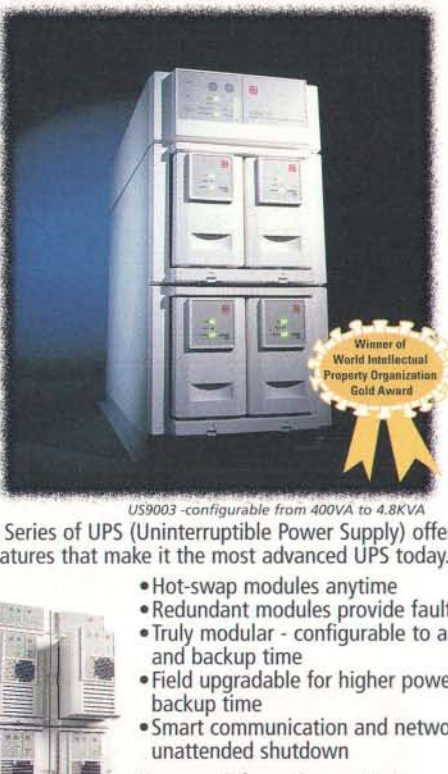
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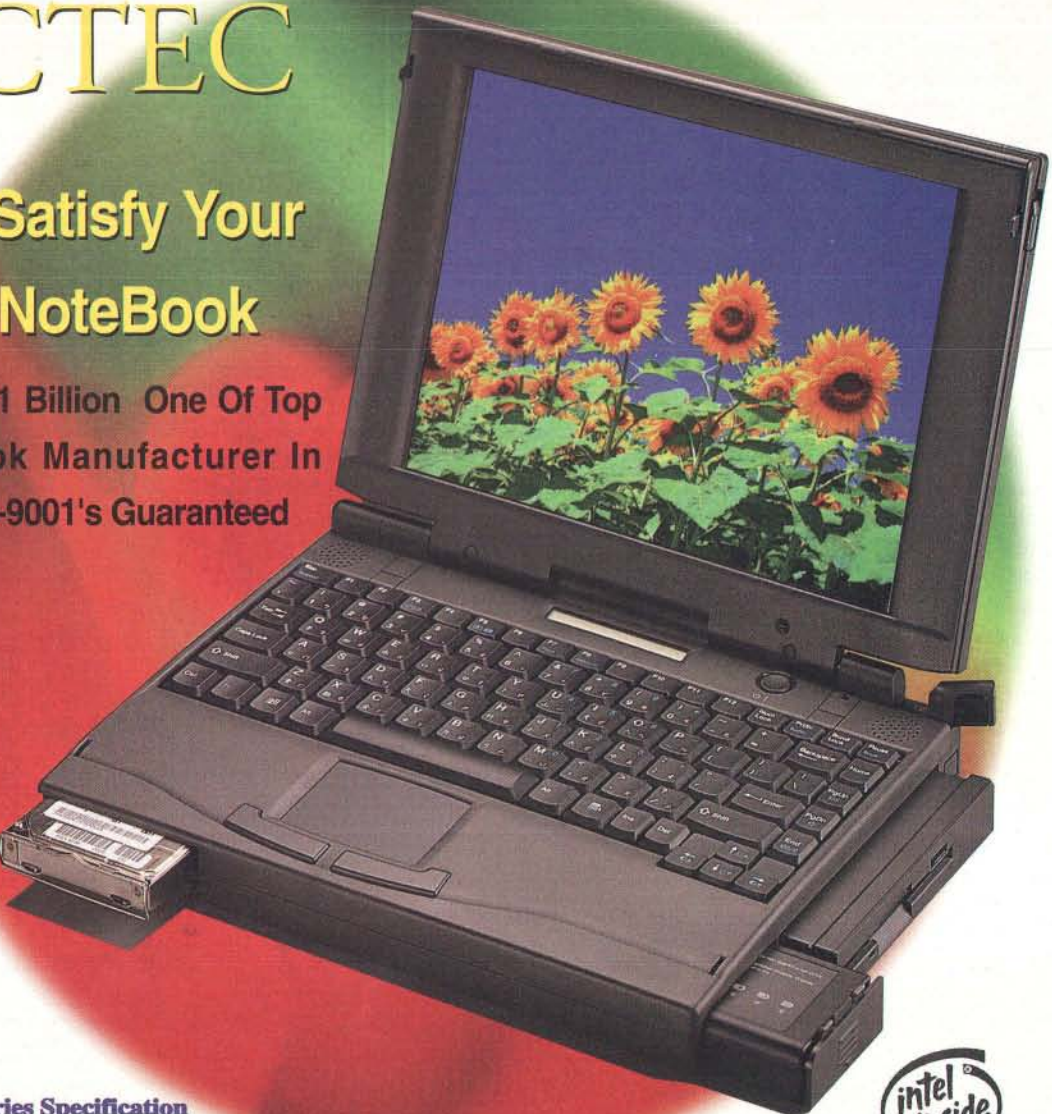

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for graphical and text elements. To define colors, users measure LAB values from a sample and then enter them into QuarkXPress. If the *gamut*—the range of colors that a device can produce—of the selected printer doesn't cover a specific color, the system informs the user. ColorSync 2 XT supports several color formats, including CMYK, LAB, LAB(LH), RGB, XYZ, Ycbcr, and YCC, as well as several image-file formats, including DCS 1 and 2, EPSF, Photoshop, Scitex CT, and TIFF.

Helios Software cooperates with Linotype-Hell, a leading prepress and publishing-systems company, and it uses Linotype-Hell's profile-generation software suite, which consists of the ScanOpen, PrintOpen, and ViewOpen programs. An advantage of the Helios product is that it uses a color model with 32,000 reference points, whereas many others use only 512.

As a QuarkXPress plug-in, ColorSync 2 XT makes color management an integral part of a popular DTP application, allowing the matching of scanned pictures and complete documents for a specific printer or monitor. It can also simulate a printing press or even a particular kind of paper on a proof printer. The program does all the color separation, gamut mapping, and black generation. As Helios president Helmut Tschemernjak puts it, "With ColorSync 2 XT, it's no longer necessary to adjust the scanner to the printer."

ColorSync 2 XT uses the Apple ColorSync 2 engine, which is integrated into the Mac OS. With its EtherShare OPI 2.0 networking product, Helios offers the same engine on an OPI server, allowing consistent color management for the Macintosh, Windows, and Unix. According to Tschemernjak, "This is where color management really belongs."

Florian Suessl of CitySatz, a lithography service bureau in Berlin, has reviewed several color-management products and concludes that "ColorSync 2 XT is currently the most elegant approach to color management; the original images remain untouched."

But the quality of a color printout depends on how well the profiles map the devices' characteristics. And the continuous adjustment necessary when, for example, a new batch of paper is started can still be costly. This is why printing experts engage in heated discussions about just how accurate color matching needs to be.

How much color difference can be discerned by a casual viewer? Studies indicate that a typical reader glances at a page for less than 3 seconds before deciding whether to examine it more closely.

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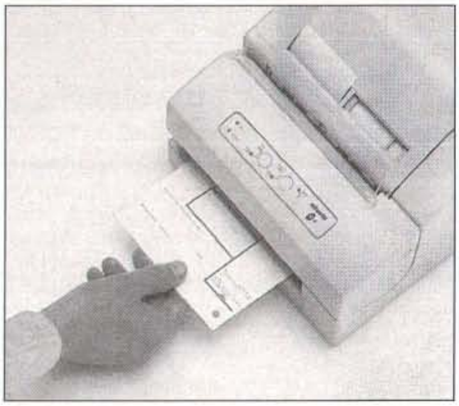

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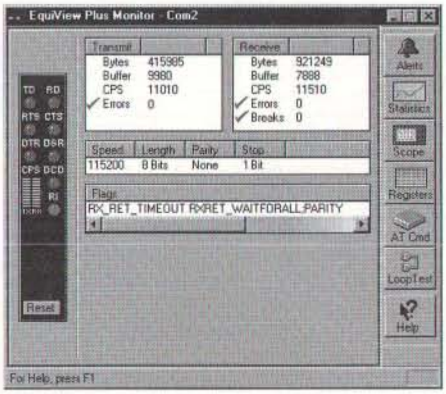

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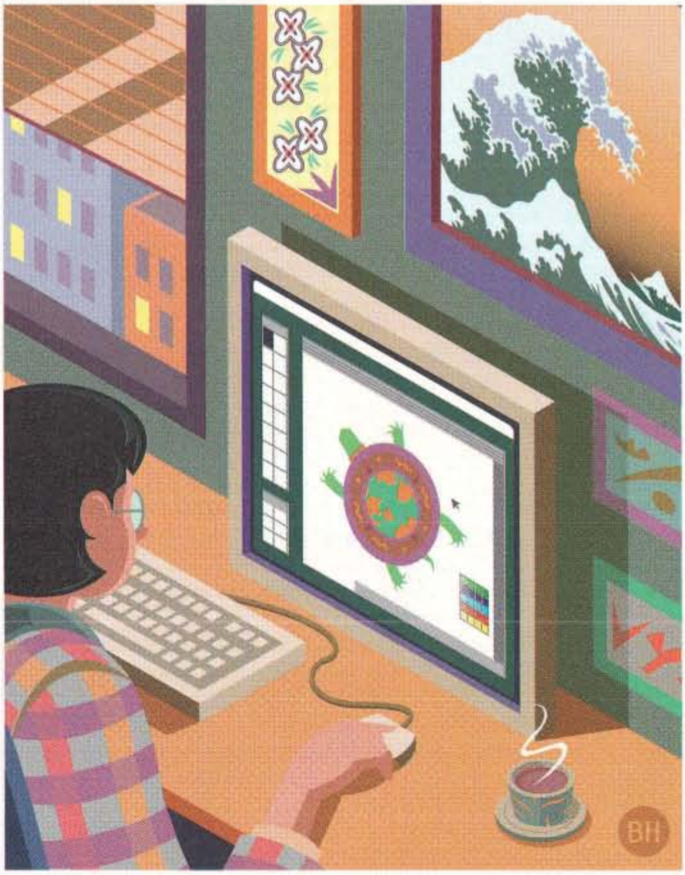
LCDs Move to the Desktop

Coming: Higher production yields, bigger screens, lower prices.

By Charlie Cohen

Japanese companies plan to introduce large-screen thin-film transistor (TFT) LCD monitors this year. This trend follows last year's emphasis on larger and better displays for laptops. These monitors will initially be pricey, relegating them to applications where space and power dissipation make CRT monitors unwieldy. Some manufacturers will provide double supertwist nematic (DSTN) models to keep prices more affordable. Laptop panels will continue to improve, but there won't be a large-scale push for sizes bigger than 12.1 inches because prices would balloon.



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Lower Prices

The next size, which is 13.3 inches, is primarily for monitor use, says Sakae Arai, a technology executive at Toshiba's LCD Marketing & Engineering division. In February 1995, IBM was the first company to introduce a 16.1-inch TFT monitor. It featured 1280- by 1024-pixel SXGA resolution, but it was meant only for Unix workstations, and its price was Y1.5 million ($13,600). In October 1996, IBM came out with a new version in the same size that works with both PCs and workstations. The cost of the new monitor is Y790,000 ($7200), an impressive reduction but still too high for the mass market.

IBM says its 16.1-inch monitor has the equivalent viewing area of a 19-inch CRT monitor, and a 13.3-inch LCD is equivalent to a 15-inch CRT. LCDs are equivalent to larger CRTs because the image on the LCD extends to the edge of the frame; on a CRT, there is normally a black band on the faceplate around the image. The once-popular 10.4-inch laptop monitor provided the same size as a 12-inch CRT monitor.

LCDs for monitors will span a range from laptop sizes to bigger than 21 inches as manufacturers jockey for position. Feature sets will differ regarding available resolutions (VGA through SXGA and UXGA), viewing angle, digital or analog video, and other parameters. Some cannot display all resolutions lower than the maximum, and full analog video is not widely available.

Despite high prices for monitors, the road to lower prices is clear—although it will cost Japanese manufacturers billions of dollars in investment costs. Successive generations of larger glass substrates have fueled larger-screen LCDs for laptops, because one secret of lowering cost is increasing the number of panels companies can fabricate on a single substrate.

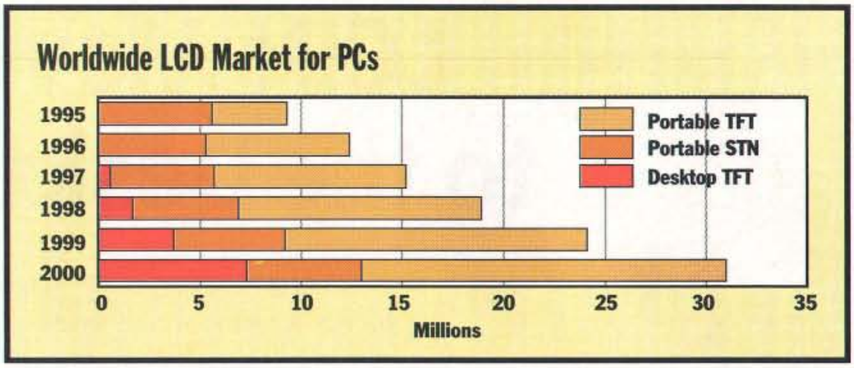
For example, manufacturers can fabricate four 8.4-inch panels on first-generation glass measuring 300 by 400 mm to 300 by 420 mm. Second-generation glass at 370 by 470 mm is big enough for four 10.4-inch panels or two 11.3- or 12.1-inch panels. Some manufacturers shoehorned so-called two-point-five-generation glass measuring 400 by 500 mm through their equipment for four 11.3-inch panels.

Sharp and DTI, and the joint venture of Toshiba and IBM, have raised the ante to 550- by 650-mm third-generation glass for six 12.1-inch panels. NEC is constructing a similar-size plant. Hitachi is following with a 650- by 830-mm three-point-five-generation plant in Mobara, Japan, scheduled to begin production in late spring or early summer. Hitachi expects to drive monitor prices down because the plant will be capable of fabricating six 13.3-inch panels on one sheet of glass—each equivalent to a 15-inch CRT.

continued

Existing plants can make only two or four panels per sheet. Hitachi's new plant will also be capable of producing four 17.X-inch panels per sheet. (X is an integer between 0 and 9.)

NEC has even larger substrate sizes in its future plans. Hiroshi Shiba, executive general manager of NEC's Display Device Operations Unit, says that it will start construction of a plant to process approximately 1-meter-square glass in 1998, with LCD production expected to start in 1999. Plans call for fabricating four 20.1-inch or larger panels per sheet of glass.



TFT panels for portables will become the most popular.

Shiba's goal is to process 10,000 sheets per month with a 75 percent yield, for a throughput of 30,000 monitor panels. He is confident the company can sell all of them. Because the intended use is monitors, the glass can be thicker than the 0.7-mm thickness used for laptops, perhaps 1.1 mm thick. Shiba admits that 1-meter-square glass is not needed for four 20.1-inch panels—about 700 by 900 mm would do—and processing equipment may not be available for 1-meter-square glass handling. However, he thinks NEC will be able to do at least 900- by 900-mm glass in the time frame given.

First-generation fabrication plants are making large-screen panels for monitors. The later-generation, larger-substrate plants produce laptop panels. Plants can

CRT-Monitor Trends

Though it's a technology that has more in common with light bulbs than with micron transistors, the CRT is still by far the major type of display in use. Some advances are being seen at both the high and low ends. At the high end, NEC is producing a CRT for color monitors that offers the advantages claimed for Sony's Trinitron and Mitsubishi Electric's Diamondtron without the disadvantages.

The shadow mask in NEC's ChromaClear tube features fine rectangular vertical slots, with connections between them in a pattern resembling the mortar lines in a brick wall rotated 90 degrees. This compares with round holes in the shadow mask and slits from top to bottom in the Trinitron's aperture grille, which is Sony's name for the shadow mask. Both the conventional shadow mask and that in the ChromaClear tube are stiff and can be blocked like a hat, while the aperture grille is stretched like the strings in a harp.

The stripe geometry of both the ChromaClear tube and the Trinitron favors sharper images, but the ChromaClear does not suffer from two prominent defects of the Trinitron: Dampering wires produce horizontal shadows in the image, and multimedia applications can produce image degradation caused by visible vibrations–visible howling of the aperture grille. NEC also claims to have better electron guns for better focus in the corners.

The new Video Electronics Standards Association (VESA) standard moves the vertical frequency from 75 to 85 Hz, according to Hermit Huang, display director for Acer Peripherals, Inc. (API). He also said that though most manufacturers offer high-end monitors with 1600- by 1200-pixel resolution, 1280 by 1024 pixels is still the most popular model. Lewis Huang, marketing manager for Chuntex Electronic (CTX), agreed. He said that for 1600 by 1200 pixels, a 160-Hz vertical frequency is needed, something that is not offered by many monitor makers.

On the low end are technologies that help CRT monitors maintain their cost advantage over alternative display types. According to CTX's Huang, budget 14-inch monitors use a supertwist-type CRT. This type of CRT uses a wrapped coil instead of a ferrobar to control the electron beam. It can't run over 40 kHz but cuts the cost of a monitor by $10 to $12. At the 17-inch level, CTX offers a monitor with a low-tech 0.39-mm dot pitch that allows for an $80 cost saving, moving the monitor's price nearer that of a 15-inch monitor.

Most new features in CRT monitors are at the interface level. Monitors with a universal serial bus (USB) control hub are getting the most press. CTX offers monitors with one type B USB port and four type A ports. CTX's Huang says, "The type B port is a hub port that connects to the system's USB out port. The four type A ports go to other USB peripheral devices." One of the type A ports needs to go to the VGA card, however, leaving only three free ports for nondisplay peripherals.

API's Huang says that there are still technical problems with USB at the hub level, specifically driver software. He believes that the entrance of multiple USB chip vendors will drive the cost of the chip down to about $2. At that price, he believes USB will become an industry standard.

Companies other than Intel that are making USB chips include Winbond Electronics, Acer Laboratories, Philips Electronics, and VIA Technologies. Making the monitor the hub-controller peripheral is a logical move. Certainly, keyboard makers can't afford the additional cost of a hub-controller USB chip. Printer or scanner makers could afford the extra component cost, but only monitors have the necessary widespread use to make USB truly take off.

Windows 97 compatibility is another consideration for monitor makers. Windows 97 may not support a new monitor if the manufacturer didn't get its technical specifications to Microsoft before the end of 1996. Such models need to have their driver information updated into Windows 97's driver library. If a particular model is not present in Window 97's library, the manufacturer sends a floppy disk with the driver or posts its new driver information on its Internet site, where customers can download it.

On Screen Display (OSD) digital control at even the 14-inch level is another new trend. CTX's Huang mentions that OSD at the 14-inch level is cheaper, on a companywide level, than using the old analog controls. This is because the manufacturer can cut down on the number of components it has to order and stock as well as standardize monitor assembly and case designs by just using digital controls. Citing one drawback to OSD, Huang says it's becoming more difficult to find universal icons that don't violate other manufacturers' intellectual property rights. **–Mark Carroll**

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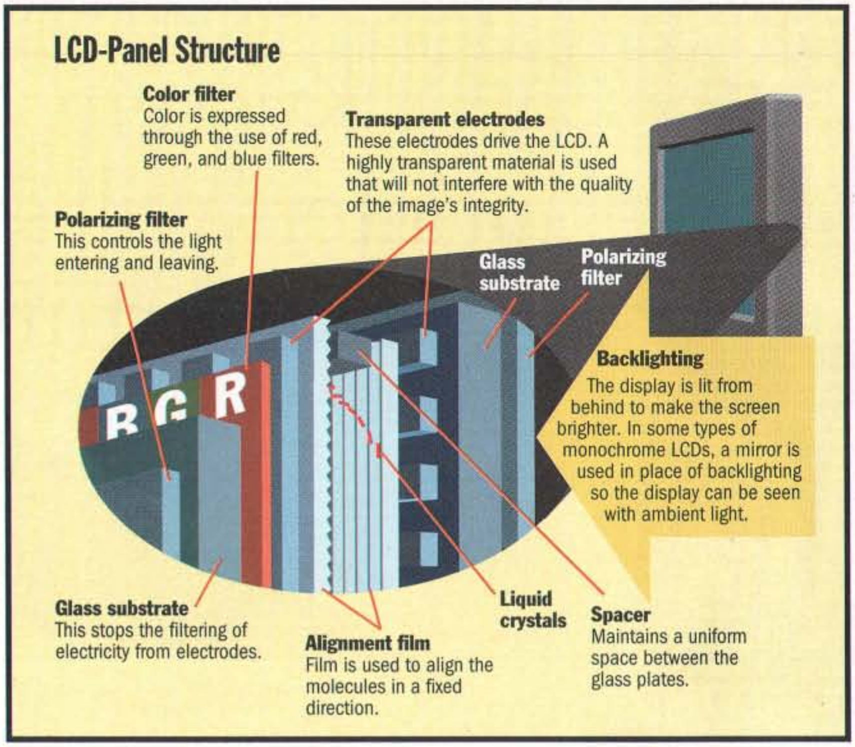
produce only one monitor panel for each sheet of glass processed, and a single defect reduces the yield for that sheet (equivalent to a semiconductor wafer) to zero. Thus, these large panels will be expensive even though a company may amortize the plant. However, as larger plants capable of producing multiple panels for monitors appear in the future, the cost will come down.

Mitsutaka Morimoto, senior manager at NEC's Technical Development Planning Department, Color LCD division, is looking for monitors and their panels to be a profit center. This is opposed to panels for laptops, on which all companies say they are losing money.

Sharp describes some of the details of the current laptop panel woes. From April through September 1995, there was a surplus of panels, and the prices plummeted. The price of a 10.4-inch panel that was Y115,000 ($1045) in April fell to about Y55,000 ($500) in September. Today, the price is approximately Y50,000 ($450). The 12.1-inch panels cost about Y70,000 ($640).


LCD-Panel Structure
Color filter
Color is expressed through the use of red, green, and blue filters.
Transparent electrodes
These electrodes drive the LCD. A highly transparent material is used that will not interfere with the quality of the image's integrity.
Polarizing filter
This controls the light entering and leaving.
Glass substrate
Polarizing filter
B G R
Backlighting
The display is lit from behind to make the screen brighter. In some types of monochrome LCDs, a mirror is used in place of backlighting so the display can be seen with ambient light.
Glass substrate
This stops the filtering of electricity from electrodes.
Alignment film
Film is used to align the molecules in a fixed direction.
Liquid crystals
Spacer
Maintains a uniform space between the glass plates.

Large LCD panels are difficult and costly to manufacture.

Viewing Angles Increase

Manufacturers have greatly increased viewing angles of the TFT LCDs used in many monitors by various methods, including changing the plane of rotation of the liquid crystal molecules and using improved optical films. The price paid for the wider viewing angle is higher-power backlights, because their light output is spread over the wider angle. Increased power consumption makes it unlikely that companies will use these panels in laptops, but it is not a problem in monitors because total power consumption is still one-third or less than that of a CRT monitor.

Fujitsu, not a leader in laptop panels, has a 15-inch CRT-equivalent 13.8-inch XGA TFT monitor with 1024 by 768 pixels for Y398,000 ($3600) and a 21.3-inch SXGA monitor with 1280 by 1024 pixels for Y1,280,000 ($11,600). The SXGA monitor's viewing angle is 50 degrees vertically and 110 degrees horizontally.

NEC has a 22-inch CRT-equivalent 20.1-inch monitor that stretches the viewing angle to 160 degrees horizontally and vertically. Morimoto says that aside from permitting group viewing, you need the wide viewing angle when viewing the monitor up close at one edge. He also claims that NEC's monitors feature full analog color for CRT-monitor compatibility. Power consumption is a modest 60 W. Toshiba's Arai says that because the pixel positions are fixed, the LCD is intrinsically a digital device, and that scan converters for multiscan work poorly. He says the computer should output a signal to match the LCD's resolution, and that the Video Electronics Standards Association (VESA) digital-interface-

Big, Beautiful and Wall-Mounted

Manufacturers cannot make plasma display panels (PDPs) in small sizes. The smallest practical panel has a diagonal of about 20 inches, because each dot, or single-color subpixel, is a gas discharge cell that you cannot miniaturize.

Companies are building larger panel sizes to 42 inches for wall-hanging TVs, but none have the high-resolution pixel count that computer users would expect in such a large display. Although manufacturers are building many PDPs with the 9-to-16 aspect ratio of Japanese HiVision HDTV, no manufacturer has announced one with the 1035 effective line resolution of Japan's HDTV signal—even for panels being developed. Those in production have only 480 pixels vertically and thus rely on scan converters to produce a lower-resolution image from HDTV. Besides large size, advantages of PDP include light emission (rather than backlight) and a wide viewing angle.

Sony is developing a 25-inch wide-screen plasma-addressed liquid crystal panel using technology Tektronix developed. However, the constraints of the plasma portion limit pixel count to that of plasma displays, even though you view the image on an LCD screen, which in turn may limit the viewing angle. Sharp has a sublicense on the technology from Sony.

Stacked Fujitsu 21-inch PDPs are in use at the New York Stock Exchange to display prices. Airport information displays could be another big user. Other applications might include the use of a giant VGA display in classrooms or conference rooms. The price of market leader Fujitsu's 42-inch panel is Y500,000 ($4500). The firm says it will invest an additional Y40 billion ($363 million) in 1998 to increase production. NEC is also producing a 42-inch PDP.

Fujitsu president Tadashi Sekizawa says that by the year 2000, the market for plasma displays will reach 3 million units per year. Even if the industry reaches such volumes, it still pales in comparison to the 100 million CRT-based TVs sold in 1996.

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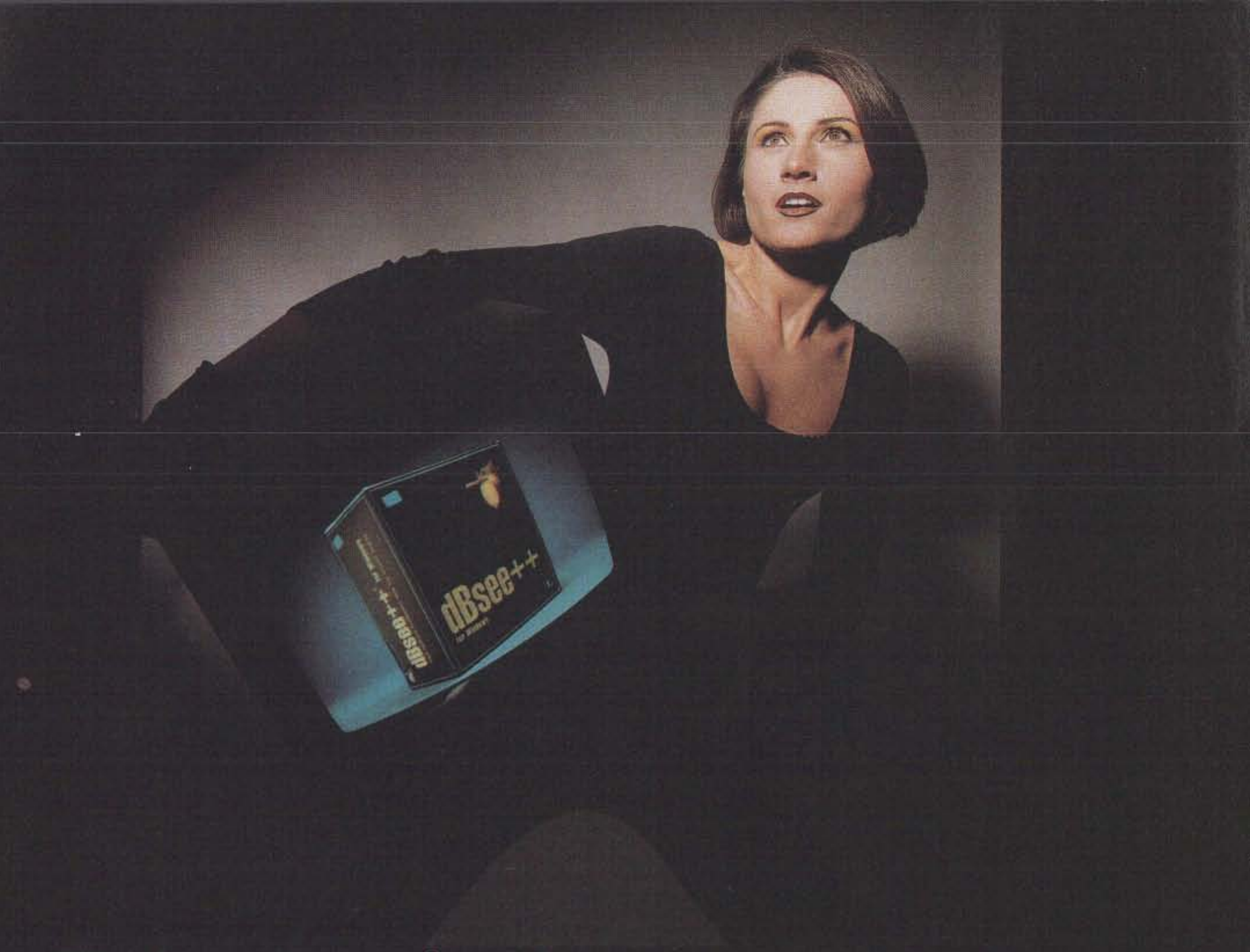

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standard proposal is a big step in the right direction.

Mitsubishi Electric, a relative newcomer to the LCD business, recently began sampling a 17-inch CRT-equivalent 15.1-inch SXGA panel made by a joint venture with ADI. Mitsubishi thinks this performance will be the de facto industry-standard size and resolution. It is less ambitious than NEC's monitor. Viewing angle is +/–60 degrees horizontally and +40/–60 degrees vertically. Color is 6-bit digital. Last March, Toshiba started sampling a similar-size panel for Y450,000 ($4000). The viewing angle is 110 degrees vertically and 140 degrees horizontally.

STN's Advantages/ Disadvantages

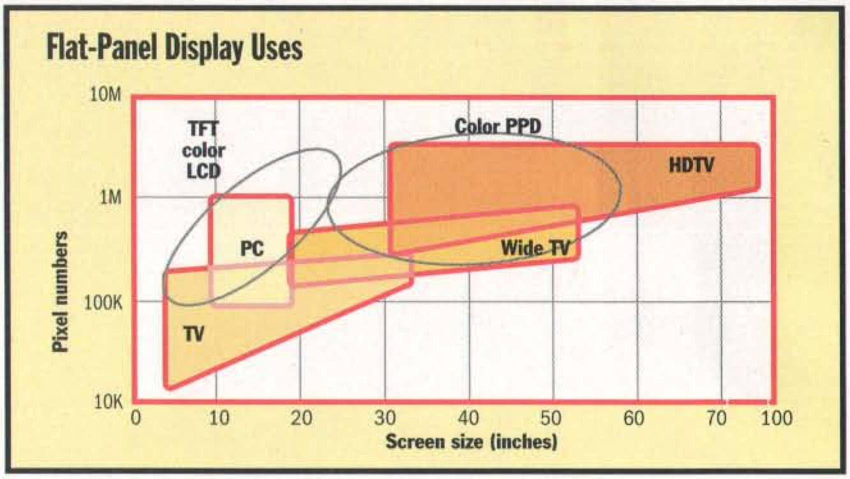
Sharp has elected to hold down prices by using supertwist nematic (STN) technology for its large monitor panels. These include a 20-inch CRT-equivalent 17.7-inch XGA panel, a 17-inch CRT-equivalent 15-inch XGA panel, and a 16-inch CRT-equivalent 13.8-inch SVGA panel. The firm has developed a new addressing mode that eliminates the image-distorting shadowing common in STN panels and increased the horizontal viewing angle from 66 degrees to 100 degrees. For its 12.1- and 13.8-inch monitors, Sharp uses TFT panels. For the consumer, DSTN is still attractive because the cost is half that of an equivalent-size TFT panel.

On the other hand, other Japanese LCD manufacturers are not optimistic about STN products. NEC has never made them, and Toshiba recently stopped production. Morimoto says that a top Toshiba executive told him that NEC made the correct initial choice. Arai says that DSTN is not a winner for the manufacturer even though facilities are less expensive because price is much lower and yield is about the same. Also, DSTN needs more drivers.

LCD Manufacturing Generations

	Size of glass	Diagonal measurements of glass panels	Number of panels
Early (8/91)	360 x 465 mm²	9.4	4
		10.4	2
Main (5/95)	370 x 470 mm²	10.4	4
		11.3, 12.1	2
2½ generation (5/95)	400 x 500 mm²	11.3	4
		12.1	2
3rd generation (7/95)	550 x 650 mm²	12.1	6
3½ generation (first half of 1997)	650 x 830 mm²	13.3	6
		17	4

Flat-Panel Display Uses



Circled parts show areas where TFT color LCDs and color PDPs are best suited.

Really Big Displays

Sharp has shown that where cost is no object, it can fabricate extremely large LCD panels, although not necessarily with high resolution. It has fabricated a 40-inch TFT LCD consisting of two smaller (specially fabricated) glass panels that are joined, with the vertical seam hidden by black-matrix processing. They aren't two 28-inch panels plucked off the line, because the company must use new patterns so that the horizontal scan runs across the short dimension of these component panels and the pixels extend to the edge of the glass.

Also, a simple calculation shows that the aspect ratio of two joined panels would be wrong. This method is probably useful only for TV, because the joint precludes small pixels and real fine resolution. Sharp's product has a pixel pitch of a relatively coarse 1 mm for an SVGA resolution of 600 by 800 pixels. Because manufacturers can now make 20-inch-plus sizes by conventional means, and because NEC plans to push the price down in the next few years, there probably isn't a great demand in the computer world for these Sharp panels.

Although they cost more initially, LCD monitors provide significant savings in power consumption, air-conditioning costs, and space. Moreover, Morimoto points out that in applications where you leave the monitor on continuously, lifetime hardware costs can be a wash even at today's higher prices for LCD monitors. CRTs become dimmer with use and must be replaced, which normally means replacing the entire monitor. However, the only component that degrades in LCD monitors is the cold-cathode backlight, which you can inexpensively and easily replace on the desktop.

A lack of radiation is another plus of the LCD monitors. Toshiba says that the maximum voltage applied to the panel is +/–10 V. About 500 V (at 4 milliamperes) is applied to the backlight, but that's too low to generate radiation. Arai says the company made measurements but detected no radiation. Hajime Sasaki, senior executive vice president of NEC, says that kilovolts are needed to generate even soft x-rays. By contrast, some buildings in New York use high-wattage fluorescent lights operating at 500 V at much higher currents in the workplace. **B**

Charlie Cohen is a freelance writer living in Tokyo. You can reach him at **editors@bix.com.**

INTERNATIONAL

What's New

Hardware

Internet videoconferencing, a powerful network PC from Japan, and better multimedia presentations.

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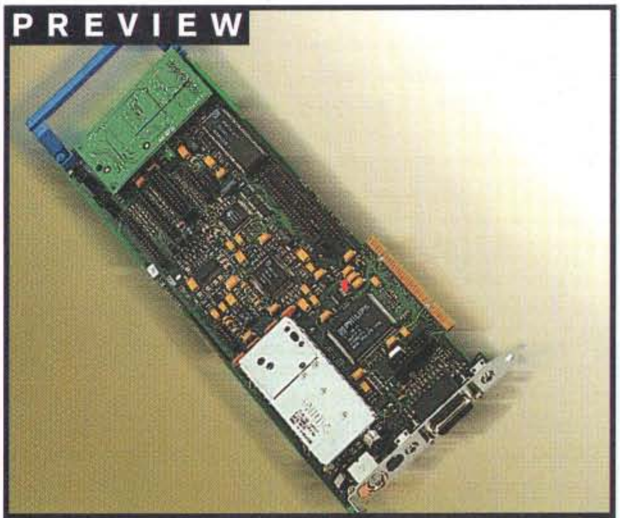

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Better Media Integration for Your PC

Today's multimedia PCs feature sophisticated 3-D graphics boards, high-speed CD-ROM drives, and CD-quality 16-bit sound boards, but most don't include a full-featured TV tuner or video mixer. With the Scenic MXB multimedia extension board from Siemens Nixdorf, you can upgrade your PC to a top-quality multimedia play station. This PCI board lets you integrate up to eight additional sound or video sources, such as a VCR, a video camera, TV, teletext, stereo, radio, and MPEG streams from CD-ROM. It also includes software that lets you mix these signals and perform basic editing functions.

You can program the integrated teletext decoder using a simple scripting language to capture information and broadcast to other Windows 95 applications. The system also automatically creates a table of all available TV programs, thus eliminating the need to search TV channels manually. In contrast to other PC TV tuners, it allows for fully scalable video windows of up to 1024 by 576 pixels.

Two options are available: an audio piggyback board with digital signal processing (DSP), and an infrared remote control. The audio DSP upgrade adds echo, reverberation, and 3-D surround sound and even allows you to run old DOS-based games in combination with these special sound effects.

If you want to turn your Win 95 PC into a multimedia play station, the Scenic MXB is an excellent choice. But before you buy it, make sure your PCI graphics board has more than 2 MB of video memory. **–Rainer Mauth**

Multimedia

New PCTV Extension Board

THE MIROMEDIA PCTV, A NEW PCI TV extension board, lets you watch TV or Super-VHS videos on your PC. It achieves video window resolutions up to 320 by 240 pixels and works with any DirectDraw-compatible PCI graphics board. The device supports the capture of video sequences at maximum frame rates. In addition, it can serve as a video phone in combination with H.324- or V.80-compatible high-speed modems.

Price: DM 180. miro Computer Products AG, Braunschweig, Germany, +49 531 21130; fax: +49 531 211399; http://www.miro.de.
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Digital Camera for Remote Uses

TARGETED AT REMOTE VIDEO INSPECTION and monitoring tasks, the Mv-Net digital networked camera transmits images of remote scenes via telephone, ISDN, Ethernet, or wireless networks, such as GSM and wireless LAN. Mv-Net automatically compresses images to reduce bandwidth requirements. The camera contains a PAL sensor, a frame grabber, a processor, local disk storage, and a network module, all in a single, compact unit. All camera settings can be controlled remotely, allowing you to modify size, compression ratios, and pan-tilt positions of images.
Price: Call company. Active Imaging plc, Maidenhead, U.K., +44 1628 415444; fax: +44 1628 415481; deborahv@imaging.co.uk; http://www.imaging.co.uk.
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AIMED AT PUBLIC-INFORMATION, VIDEO-on-demand, computer-based training, and point-of-sales applications, the 4-ReelTime/P four-channel MPEG-1 video-playback card features hardware audio/video synchronization and low heat dissipation, which are both crucial to industrial applications. It provides four concurrent playback channels from a standard EIDE disk drive, thereby utilizing only 20 percent of a Pentium processor's performance. The 4-ReelTime/P comes with drivers for all flavors of Windows and Unix and includes sample code for quick integration into a custom system.

Price: Call company. Imagine Graphics, Ltd., Saint Albans, U.K., +44 1727 844744; fax: +44 1727 811660; 72132.502@compuserve.com.
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Connectivity

Colibri Links LANs to the Internet

Colibri, a new ISDN router for Basic Rate Interface (BRI), links corporate LANs to the Internet. It provides IPX and IP routing over two B channels and full ISDN functionality. Because the device runs PPP over ISDN, you can connect it with any other router. It also allows for the linking of both channels over Multilink PPP. Additionally, the system supports PAP/CHAP and provides cost and line management.
Price: Call company. AVM Computersysteme Vertriebs GmbH, Berlin, Germany, +49 30 39976 0; fax: +49 30 39976 244; http://www.avm.de.
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High-Speed Modem with Upgrade Path

The CommWave V.34 PnP offers a simple but efficient upgrade path to the new modem standards. Because this V.34 high-speed modem includes a native/host signal processor, it can run any communications protocol after the proper software is installed. The CommWave package includes an answering machine and pager service and supports Class 1 and Group 3 faxing.
Price: DM 199. Anubis Electronic GmbH, Saarbrücken, Germany, +49 68 97 90 88 0; fax: +49 68 97 90 88 99; anubis@t-online.de.
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Network Computer System

If you're ready to throw away the Wintel paradigm, Funai's NC system may be for you. Its network application terminal uses an ARM7500FE CPU and has 8 MB of RAM. ROM is provided through a flash memory card. Video output is to either a VGA monitor or an NTSC/PAL TV. Ports include an EPP/ECP parallel port, a keyboard port, a mouse port, a 10-Mbps Ethernet port, and a 28.8-Kbps fax modem or ISDN port. The NC system also has a JSAT-3 satellite receiver. Reception frequency is from 950 to 1895 MHz, with a 27-MHz bandwidth. Transmission speed is 42 Mbps for MPEG-2 video and MPEG-1 audio reception. Also included with the NC system is an eight-speed CD-ROM drive designed to handle HTML and Java data formats.
Price: Call company. Funai Electric Co., Ltd., Tokyo, Japan, +81 3 3 254 5612; fax: +81 3 3 254 0168.
Circle 1019 on Inquiry Card.

A 16-port Ethernet Hub

KYE Systems manufactures and markets a 16-port 10Base-T Ethernet hub. Data is transferred at a rate of 10 Mbps and conforms to the IEEE 802.3 Ethernet standard. Sixteen STP (RJ-45) workstation ports are provided, as well as an additional STP port for crossover connection, one BNC port, and one AUI port for hub-to-hub connection via coaxial cable. Up to four hubs can be connected this way. The KYE hub allows data recovery without signal distortion and offers automatic partitioning of faulty segments.
Price: Call company. KYE Systems Corp., Taipei, Taiwan, +886 2 995 6645; fax: +886 2 995 0704.
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Internet Videoconferencing

Videum is a high-performance audio/video capture and playback solution for Windows-based notebooks. Its combined audio and video processing provides full videoconferencing functionality in a single-card solution. In addition, Videum supports Internet videoconferencing, full-duplex audio, and 30-frame-per-second video capturing at 352 by 240 pixels.
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Storage

CD-ROM Duplicator

Greta Taiwan offers a series of CD-ROM duplicators for the noncommercial market. The basic model offers 2x writing speed and works as a stand-alone product. The deluxe model also writes at 2x speed and can be used either as a stand-alone unit or in conjunction with a PC. The necessary software is included with the deluxe model, as well as a 2-GB hard drive. An LCD panel is also standard, as are audio-in and audio-out ports. Both models can duplicate most CD standards, including CD-ROM Modes 1 and 2, CD-ROM XA, CD-DA, Video CD, and Multisession.
Price: Basic model, $1999; deluxe model, $2799. Greta Taiwan, Inc., Taipei, Taiwan, +886 2 375 2612; fax: +886 2 375 2049; http://www.cd-dupe.com/.
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Disk Arrays for Five SCSI Drives

A new family of disk arrays, the CI-Design 3500, provides slots for up to five 3.5-inch SCSI drives. The arrays include a power supply and a heat sink and comply with the European CE standard. LEDs on the front of the case show activation of each disk.

Price: Starts at DM 150. PSP Pillokat-Systeme + Peripherie GmbH, Hahnstätten, Germany, +49 6430 2222; fax: +49 6430 2220.
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RAID System Supports Write-Back

The new version of Xyratex's R9000 RAID system includes such features as a write-back cache, UPS support, Global Hot Spare, and remote diagnostics via modem. The R9000's case can contain up to seven SCSI drives.

Price: Call company. Xyratex, Havant, Hampshire, U.K., +44 1705 486363; fax: +44 1705 492228.
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Parallel Computing

ParaStation Turns PCs into Supercomputers

With the ParaStation communications adapters, you can turn a network of standard PCs into a high-performance, cost-effective, parallel supercomputer. These PCI boards add a communications processor and four link modules to each PC and have their own routing tables, as well as three input buffers and one output on-board. Data transmission takes place on 60-wire flat ribbon cable with a maximum range of 10 meters. The ParaStation adapters can be configured in either ring or toroidal mesh topologies and achieve a routing delay of only 250 ns per node and a maximum throughput of 15 MBps.
Price: Call company. Hitex, Karlsruhe, Germany, +49 721 9628 133; fax: +49 721 9628 189; Int.Sales@hitex.de; http://www.hitex.de.
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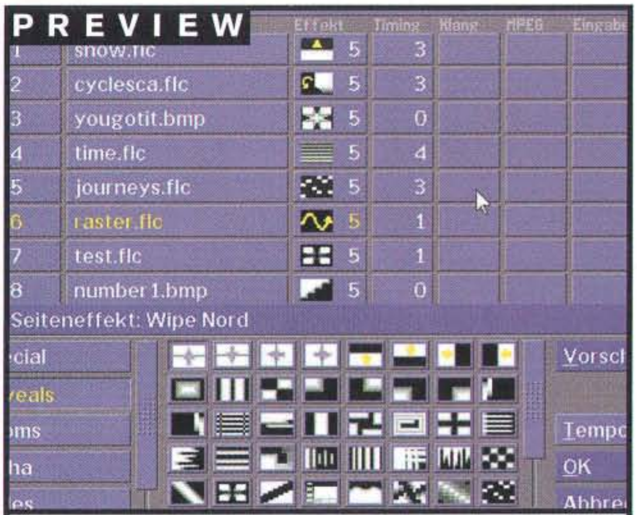
PREVIEW



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2	cyclesca.flc		5	3			
3	yougotit.bmp		5	0			
4	time.flc		5	4			
5	journeys.flc		5	3			
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More-Professional Multimedia Publishing

Producing good-looking, professional presentations can be a struggle, but nothing stands out more than a poor presentation. The MultiMedia Publisher PB100, Scala Computer's latest run-time version of its popular MultiMedia MM100 package, will make you look like a professional. For example, it offers more than 250 different ways of producing wipes, and you can define variables and use conditional branching to create interactive scripts that allow you to include different scenarios, depending on your audience's input.

The software lets you combine sounds from various sources and even play sound files on top of each other to create voice-overs on top of music. An integrated color mixer enables you to combine different clip art or backgrounds on the same screen with automatic conversion of palettes. Because the PB100 includes a run-time version of the MM100, anyone can run your presentations without having the program installed. With the Locked Scripts feature, you can make sure the recipient of a presentation won't be able to edit it. In fact, Scala's MultiMedia Publisher PB100 gives you almost too many features. **–Rainer Mauth**

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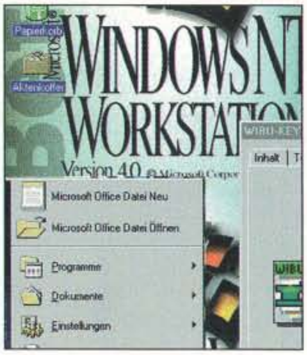

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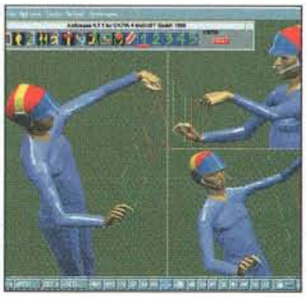

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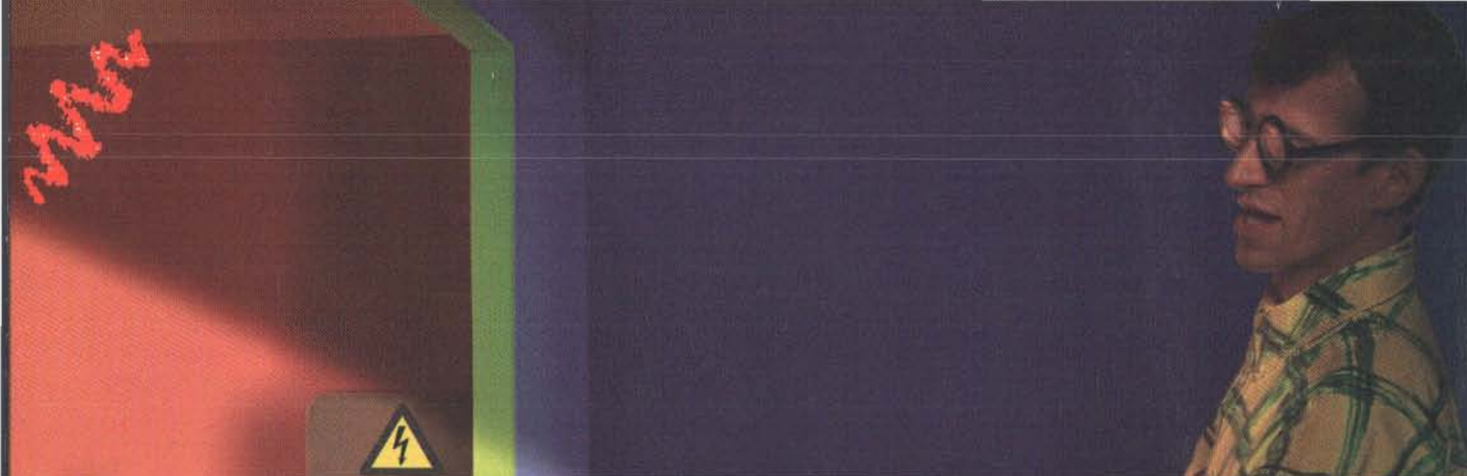

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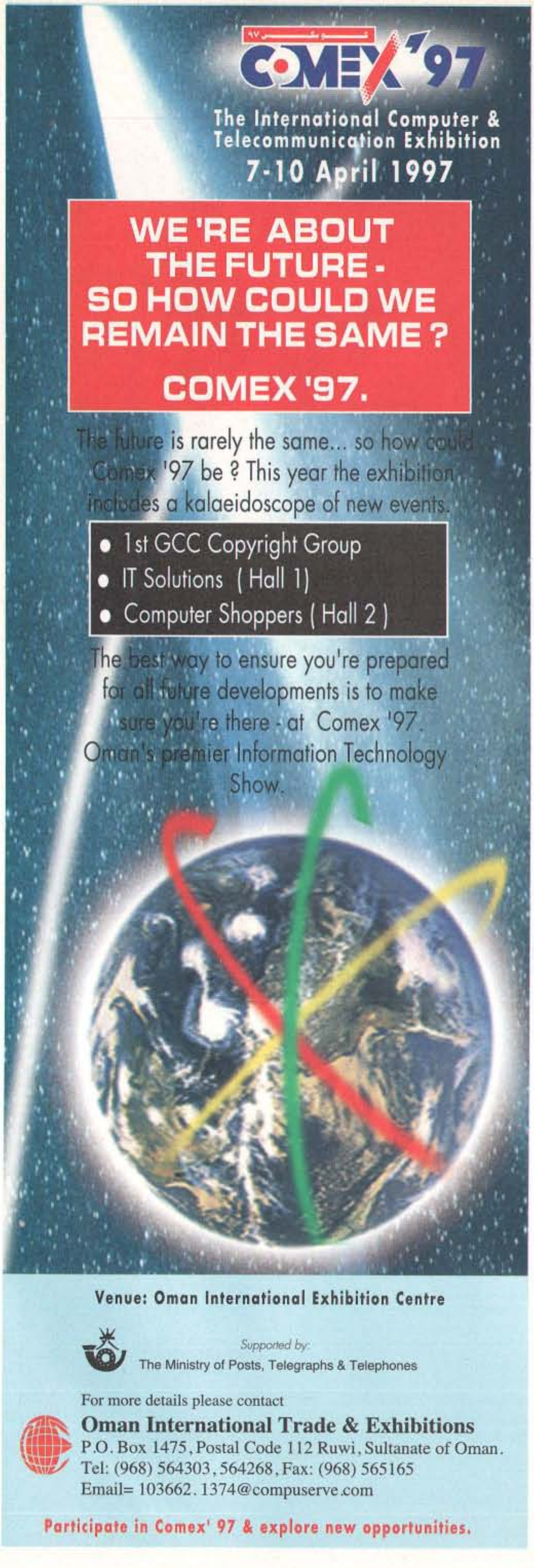

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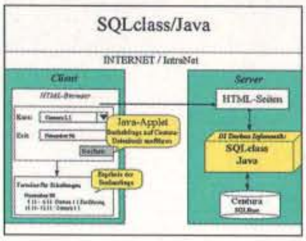

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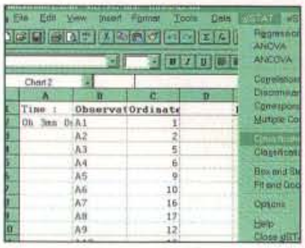

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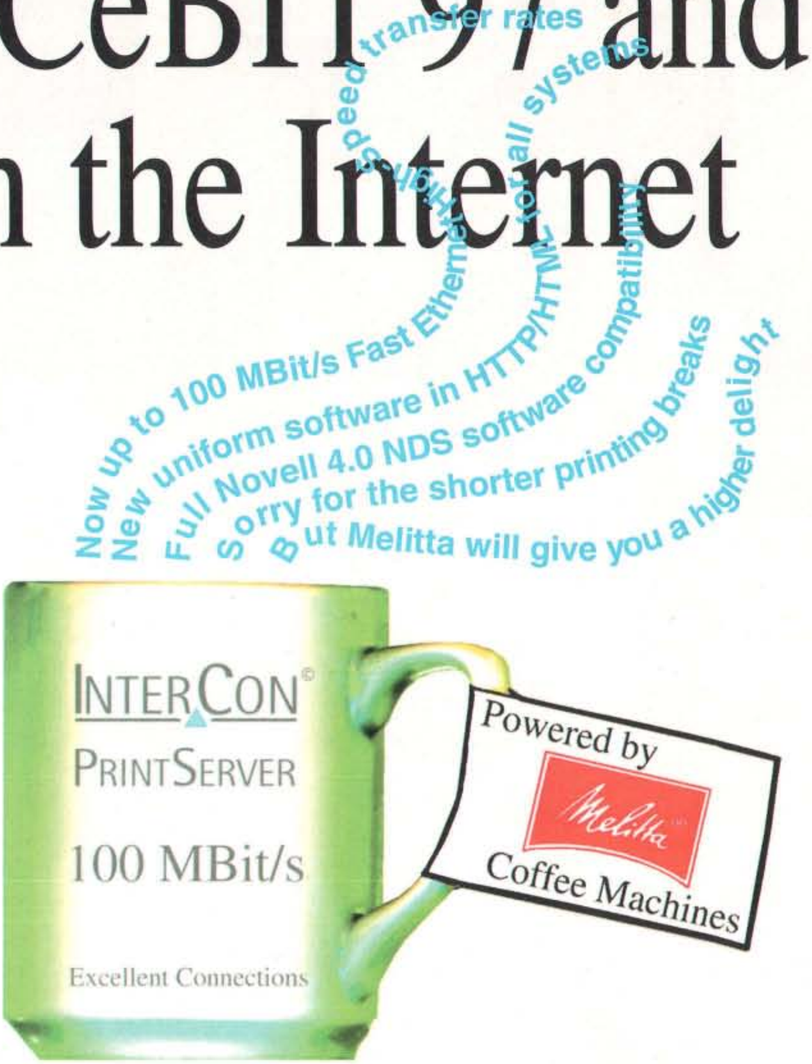

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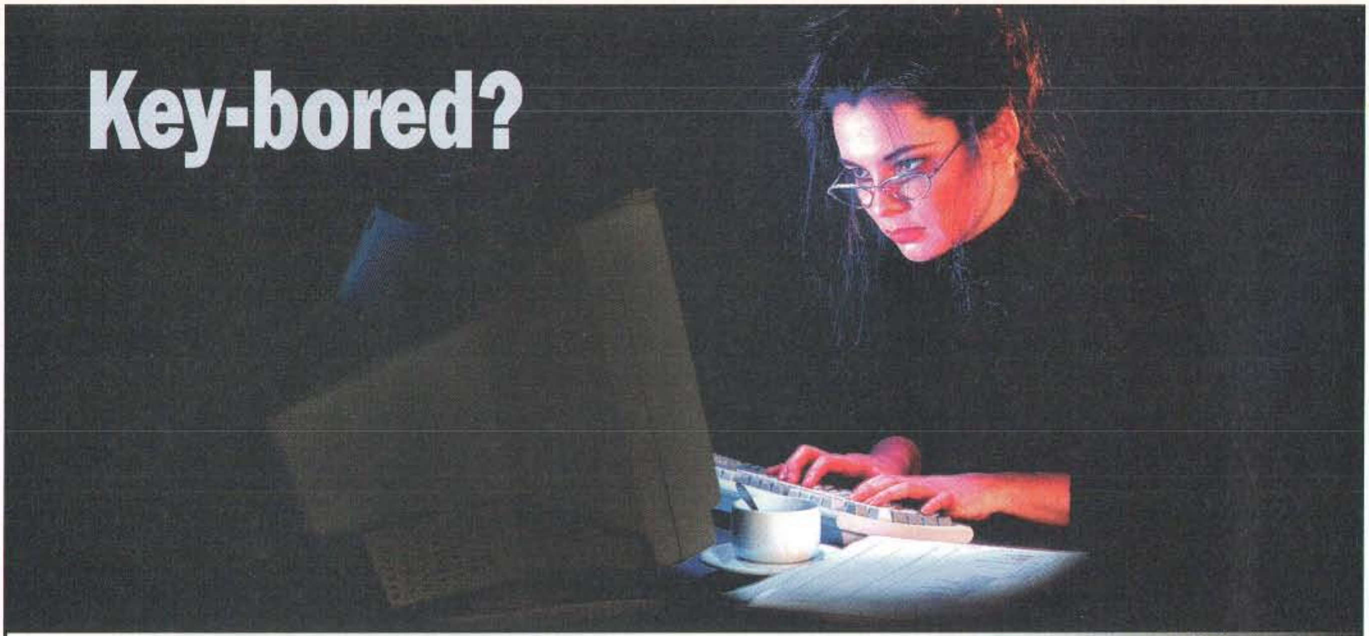

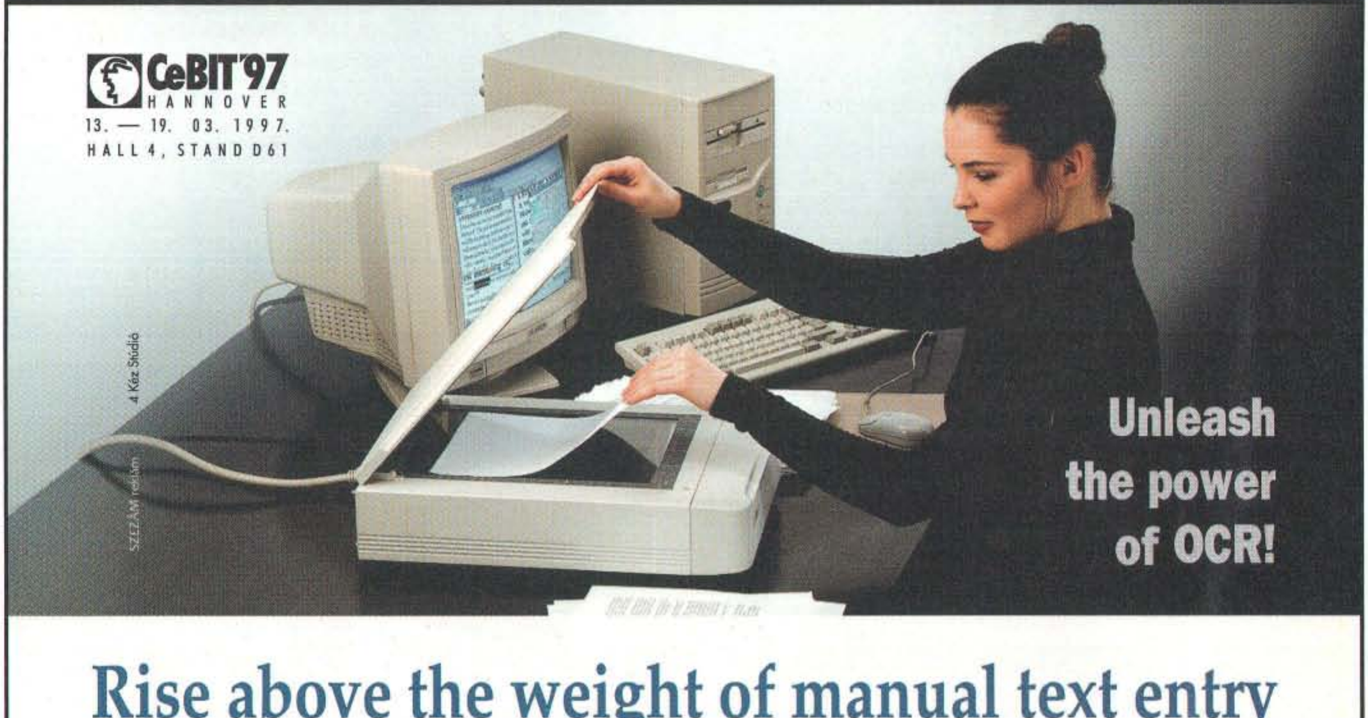

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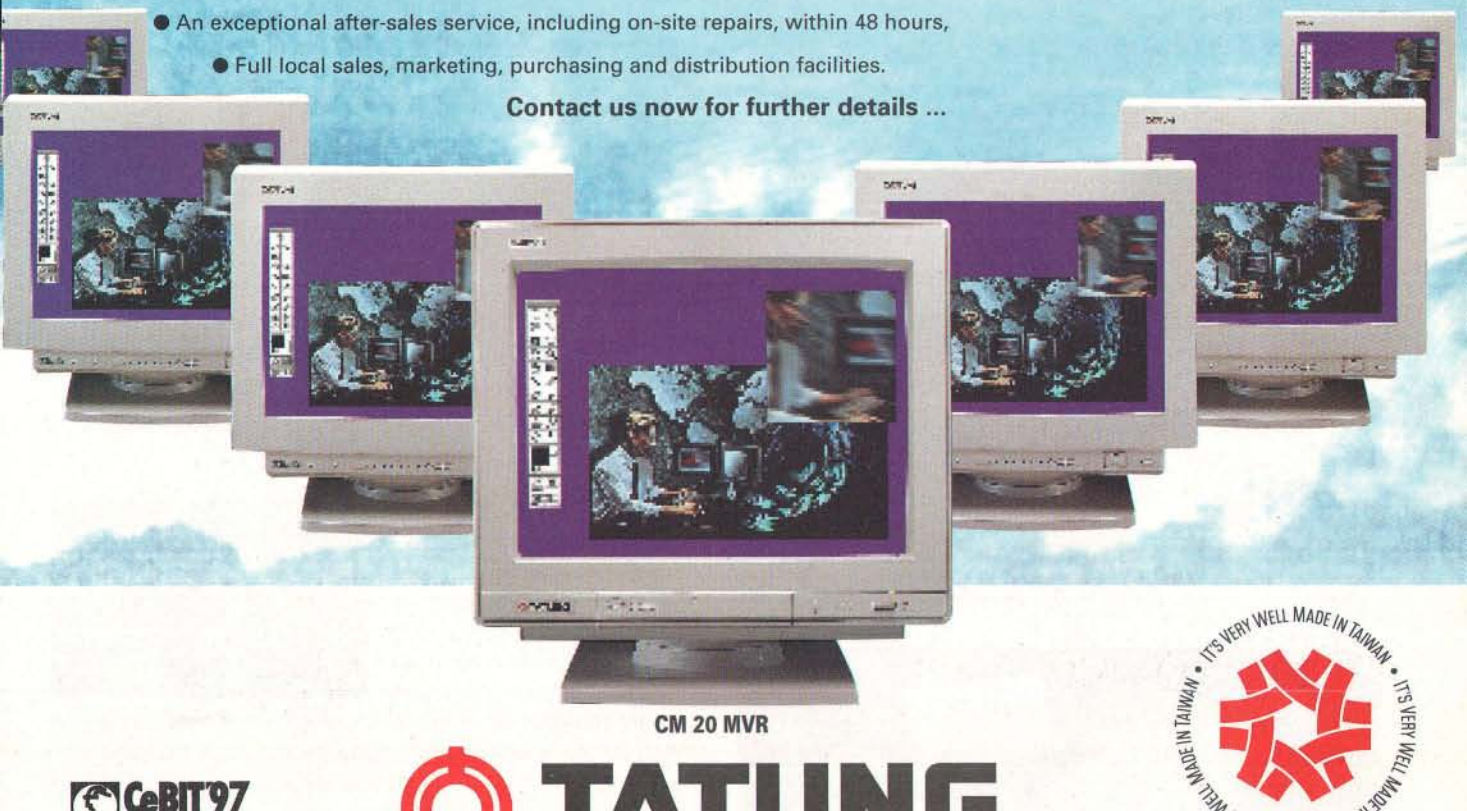

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Taiwan's IT Industry

Taiwan's IT Industry

Chin-Yeong (Colley), Hwang

Since its inception in the early 1980s, Taiwan's IT industry has performed well. The industry started from manufacturing monitors and terminals for international vendors; this was the foundation of a local industry, which in the middle 1980s became an assembly operation based on motherboard production capability.

With OEM orders flowing in, the scale of Taiwan's industry grew dramatically in the early 1990s, and is now far removed from its humble beginnings. In 1996, Taiwan's market share in fourteen IT product categories exceeded 30% of the world total, and in nine of these categories, it exceeded 50%. The balanced distribution of the industry structure, which is internally supported, has allowed Taiwan to become a "one-stop shopping center" for the world's PC needs, and king of the PC market place.

According to MIC/III (Market Intelligence Center/Institute for Information Industry) figures, Taiwan's onshore IT production value for 1996 was US$16.4 billion, a 20.8% increase on US$13.6 billion in 1995. The fastest growing product segments were notebook PCs, desktop PCs, desktop scanners, and motherboards — all of which require a high level of systems integration capability and have high software and other value-added requirements. The strong performance of these product segments has been an important factor in maintaining the steady development of Taiwan's onshore production.

In fact, Taiwan's IT production value is much higher than the above figures for onshore production, as Taiwan's manufacturers have gradually moved production offshore. A shortage of labor and other factors have led many manufacturers to relocate production in Malaysia, Thailand, and mainland China, leading to a huge increase in offshore production value. From US$973 million in 1992, Taiwan's offshore production value jumped to US$7.8 billion in 1996, creating a combined onshore/offshore production value of US$24.2 billion for 1996. Of Taiwan's hardware production, 32.1% is now accounted for by offshore production.

The international position of Taiwan's IT industry

Falling profit margins have forced many vendors to seek OEM contractors who can provide quality at a reasonable price. Taiwan has the advantage over its main competitors by virtue of its early entry into the industry; it has already achieved the economies of scale that the present level of industry development requires, and is, therefore, able to meet the

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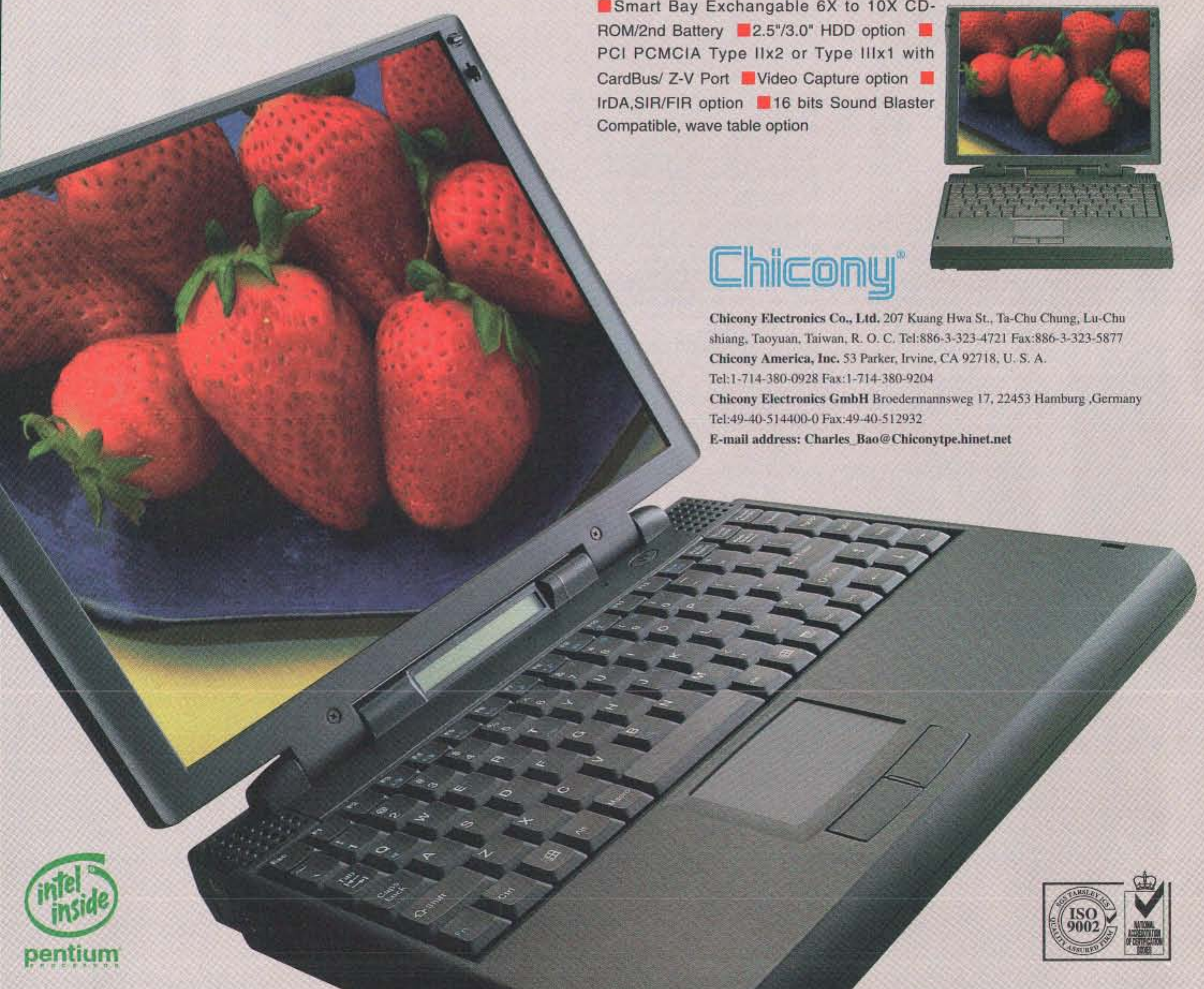

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US$ million

Rank	Category	1995	1996*	1996*	
		Value		Growth	Proportion
1	Monitor	7,271	7,872	8.3%	32.6%
2	Notebook PC	3,339	5,331	59.7%	22.1%
3	Desktop PC	2,314	5,331	45.7%	22.1%
4	Motherboard	2,222	3,075	38.4%	12.7%
5	SPS**	895	1,078	20.5%	4.5%
6	Desktop scanner	434	687.4	58%	2.8%
7	Graphics card	516	558	8.14%	2.3%
8	CD ROM	305	528	73%	2.2%
9	Keyboard	369	415	12%	1.7%
10	Sound Card	123	228	85%	0.9%
11	Mouse	191	198	3.6%	0.8%
12	Terminal	161	136	-15.2%	0.6%
13	Hand-held scanner	101.9	98.5	-3%	0.4%
14	Video card	199	93.4	-535%	0.4%
	Subtotal	18,440.9	23,670.3	28.4%	97.9%
	Other	430.1	503.7	17.1%	2.1%
	Total	**18,871**	**24,174**	**28.1%**	**100%**

Figure 1: Taiwan's PC hardware production value in 1995/6, by product type.
Source: MIC/III

** Forecast ** Switching power supply*

OEM needs of international vendors. This situation has provided the main impetus for the continued rapid growth of Taiwan's IT sector.

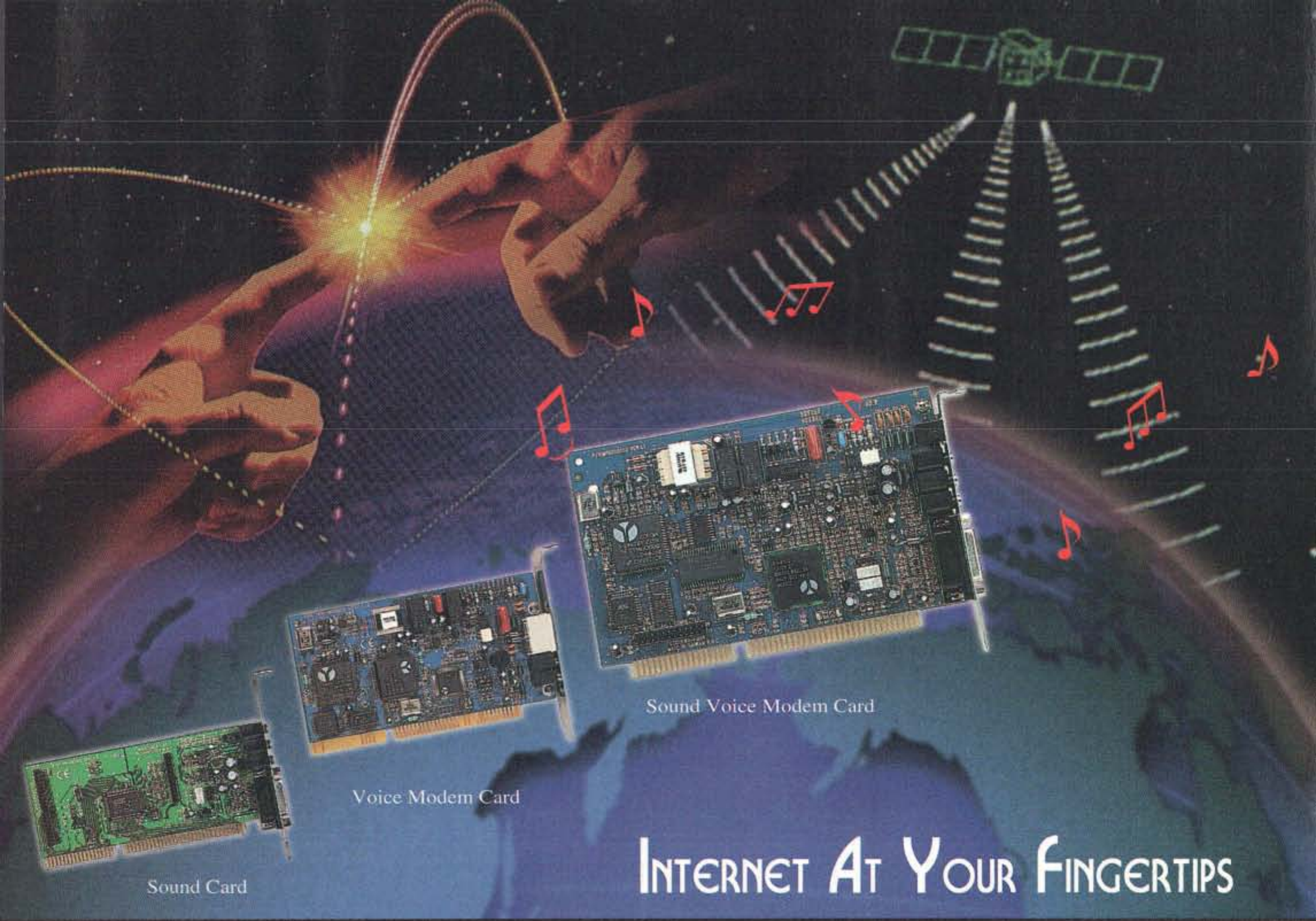
According to MIC figures, the scale of Taiwan's IT industry is larger than that of many of its competitors, including Singapore, Germany, France, the UK, Italy and South Korea, and is now firmly established among the top three IT manufacturing nations (see Figure 2).

Changes in the business environment and the response of Taiwan's manufacturers

Although the success of Taiwan's IT industry over the last ten years has been yet another aspect of Taiwan's economic miracle, the changing business environment has created new challenges, which Taiwan's manufacturers must overcome if they are to maintain their position in the world IT market. Recent years have seen the formation of regional economic blocs in the shape of the EC and NAFTA. Moreover, the trend toward an international division of labor, and the implementation of logistical management systems have had a significant impact on Taiwan's industry environment.

Changes in competition base and core resources

In the early 1980s, when Taiwan first entered the IT industry, it



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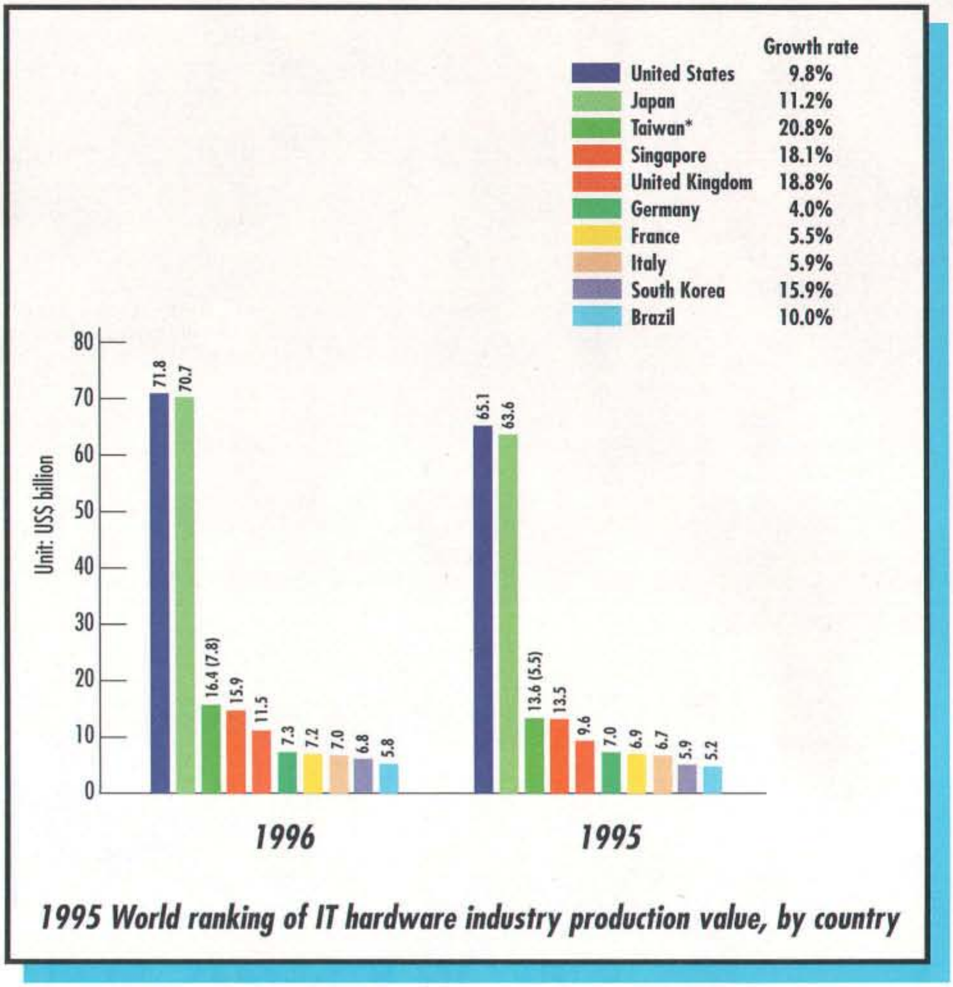
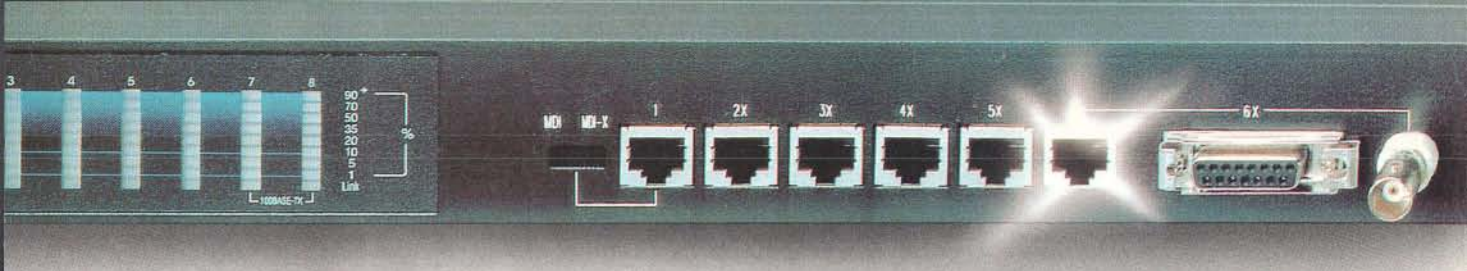


1995 World ranking of IT hardware industry production value, by country

Figure 2. 1995 World ranking of IT hardware industry production value, by country
** Figures in parentheses represent export production values.*
Source: MIC/III

specialized in low-cost assembly. Price was its main competitive advantage and profit margins were slender. In the middle 1980s, Acer, Mitac, and engineers in the electronic games segment began assembly of semi-finished goods. They established the foundation of Taiwan's PC board-based peripherals industry, centered on Taiwan-made motherboards. During this period, Taiwan's competitive advantage was derived from its abundance of skilled engineers, who — while operating out of small and medium-sized enterprises and as specialist manufacturers — became a vital part of the global IT manufacturing structure.

Coming into the 1990s, Taiwan began to face high land and labor costs, which, in addition to lower tariffs granted to other nations through the General System of Preference (GSP), created considerable pressure on the labor-intensive segments of Taiwan's IT industry. The offshoot was that many manufacturers moved their labor-intensive



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procedures offshore. Operating as multinational companies and combining offshore production with a strong domestic mass-production capability, Taiwan achieved a winning position. During this stage, management capability became the key to successful competition.

Taiwan's mass-production capability created a huge demand for components; to establish a stable source of components, many manufacturers invested heavily in the production of key components. The bulk of the investment went into semiconductor components, which in turn made 8-inch semiconductor wafer production a driving force in Taiwan's IT industry. Successful competition depended on access to capital, and the technology required for upgrading the semiconductor and other components segments.

In 1995, the "logistic production system," jointly formed by Compaq and Mitac, established a new model of international operational cooperation in the IT industry. If Taiwan companies are to retain large international OEM orders, they must now take into account proximity to markets, marketing support. and maintenance services; to achieve these goals and effectively establish themselves in the international market place, Taiwan manufacturers will have to set up assembly plants in their main markets. Not all companies have the ability to become truly international companies, and the ability to attract staff with international experience will be the key to success.

Well-known international IT vendors with high management and marketing costs will find it increasingly difficult to maintain mass production of PCs and components at competitive prices. Production will, therefore, be contracted out to Taiwan and other Asia-Pacific countries; this influx of orders will delight Asia-Pacific manufacturers, but to ensure that such orders continue, they must invest heavily to expand their mass production facilities and establish assembly plants close to main markets.

It can be expected that the nature of international competition will continue to change, and Taiwan will be able to rely on its mature operational structure acquired through many years of experience. With these "core resources," which are unique to Taiwan's IT industry, Taiwan will, in the short term, continue to be the invaluable assistant to international IT firms in their battle to gain market share (see Figure 3 for the shift in "core resources" from 1980).

Competitive strategy and product differentiation

In the second half of the 1990s, Taiwan's industry structure has matured. Over the years, a high level of integration has evolved between production and marketing, a competitive advantage that new entrants to the market will find difficult to match. Furthermore, many Taiwan companies have acquired capital through stock issues to further facilitate their operations. New entrants to the market will generally have to join in cooperative relations with established companies, while many new companies will simply be "spun off" by large, established firms.

To take an example from motherboard production: Asustek

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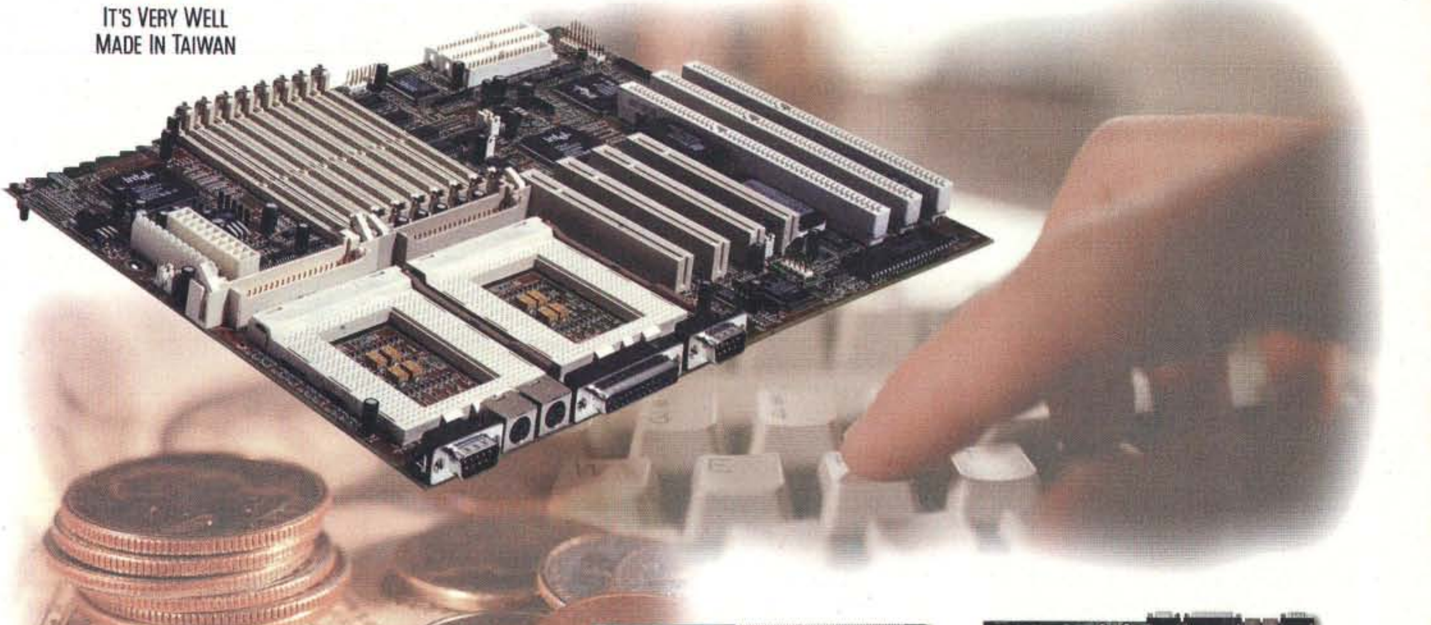

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Companies such as GVC, Elite, and FIC, which target the major international vendors, are all working towards a global production strategy and maintenance system, so that they can benefit when IBM, Compaq, and other major firms increase their global market share. Motherboard manufacturers who target vendors at the national level, such as Microstar, Gigabyte, and Soyo, have also established deep roots in their respective markets. Although Taiwan's motherboard manufacturers will not be free of pressure from Intel, Taiwan's comprehensive foundation in motherboard production and the industrial structure that has evolved over the years will remain its strongest guarantee of retaining a position as one of the world's top motherboard manufacturers.

Forecast for the next three years

Taiwan's combined offshore/onshore IT production in 1996 was valued at US$24 billion; this figure is likely to rise to US$31 billion in

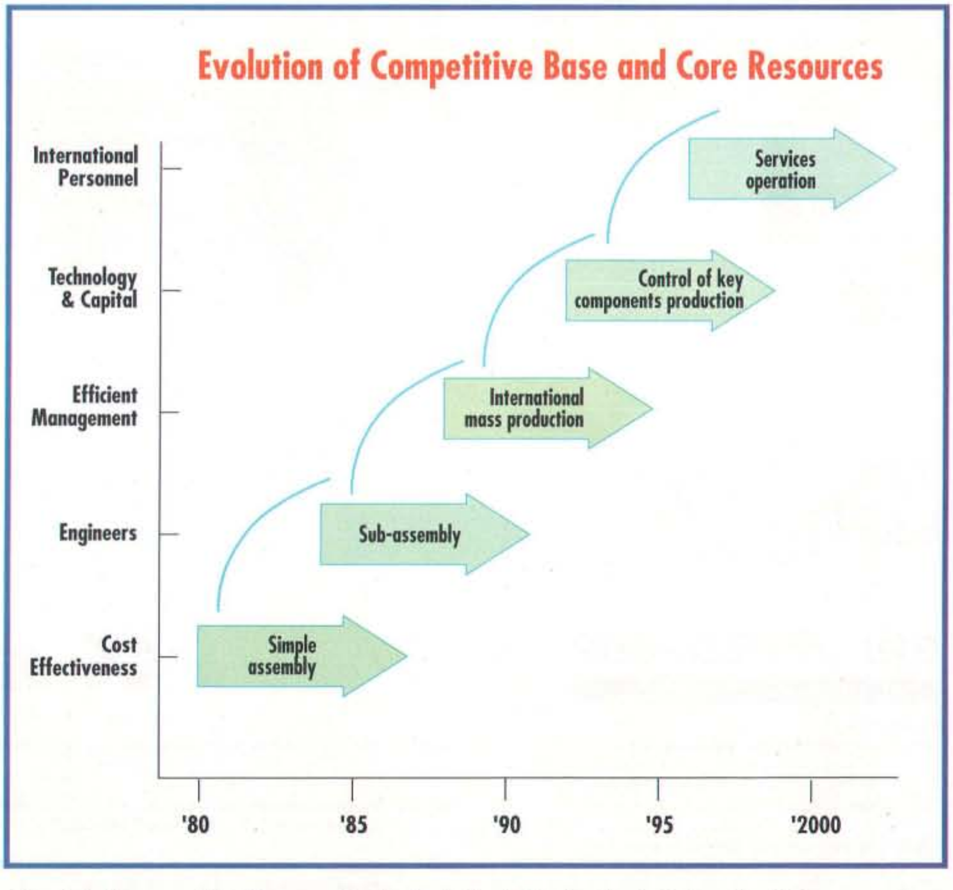

Figure 3. Continuous evolution of new operational cycles; the length of each cycle gets shorter with each stage.

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1997. The driving force behind this growth will be the expected stable growth in PC demand over the next few years. The notebook PC, which contributed so much to the strong performance of Taiwan's IT industry in 1996, will maintain high growth into 1997, primarily due to high LCD prices over the short term. The notebook computer segment is expected to maintain the highest level of growth in Taiwan's IT industry.

Aside from PCs, computer network products, CD-ROM drives and other products will continue to make significant contributions to Taiwan's IT production value. Over the next two to three years, they are expected to maintain high levels of growth. With the fall in LCD prices expected in 1998, the contribution of this segment will fall, and overall growth is expected to fall to about 15% at this time (see Figure 4).

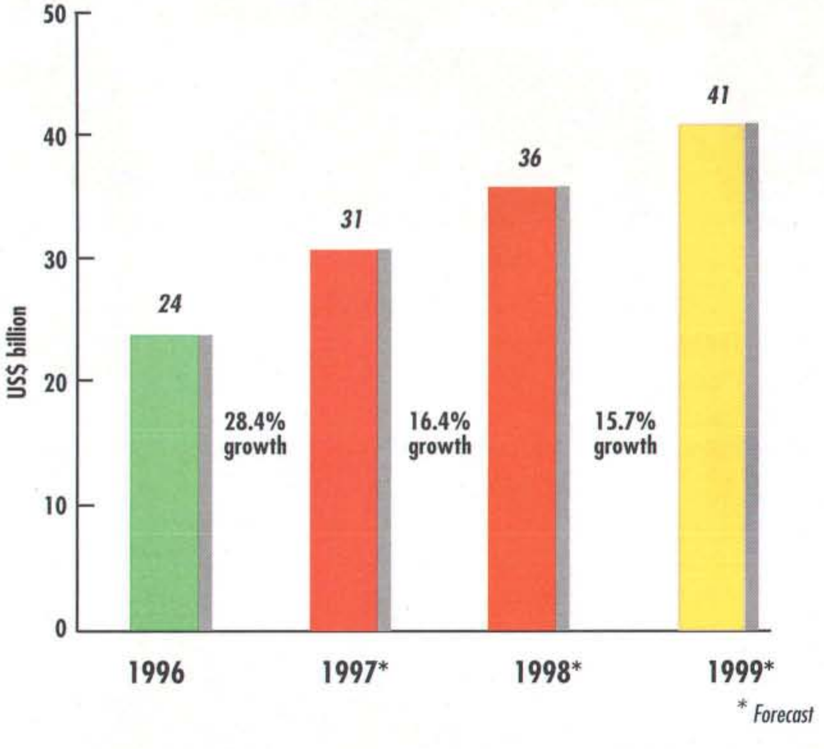

Figure 4 Growth of IT hardware production in 1996-99.
Source: MIC/III, Nov. 1996

Although Taiwan does not have the same solid foundation in advanced technology as US, Japan and some European countries, it does possess a production capability that is the fruit of many years' experience. As Taiwan establishes itself on a multinational model, its foundation in mass production will allow it to retain strong appeal to international IT vendors. As an important link in their competitive strategies, Taiwan's IT industry will continue to grow into the future. ■

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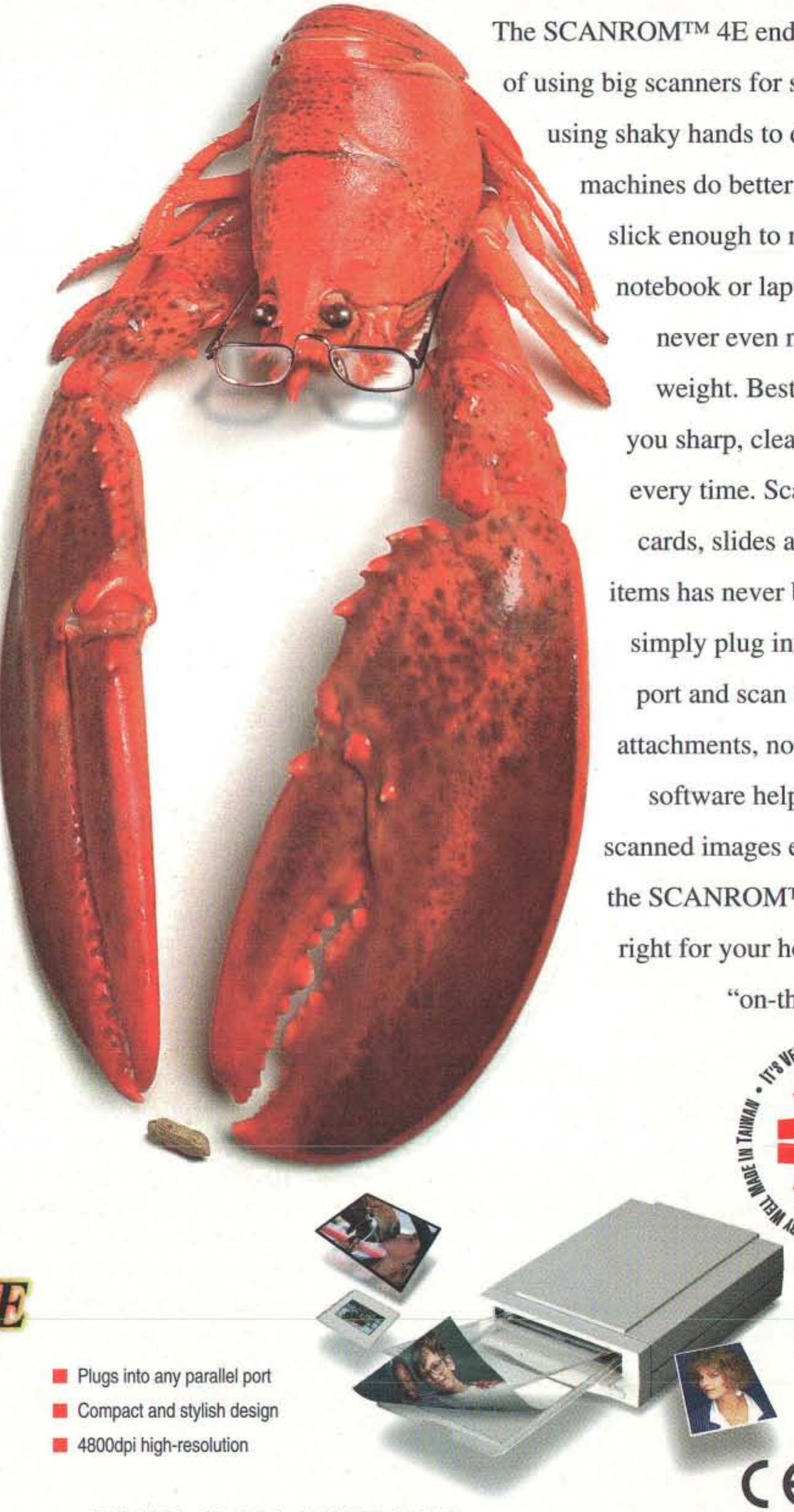

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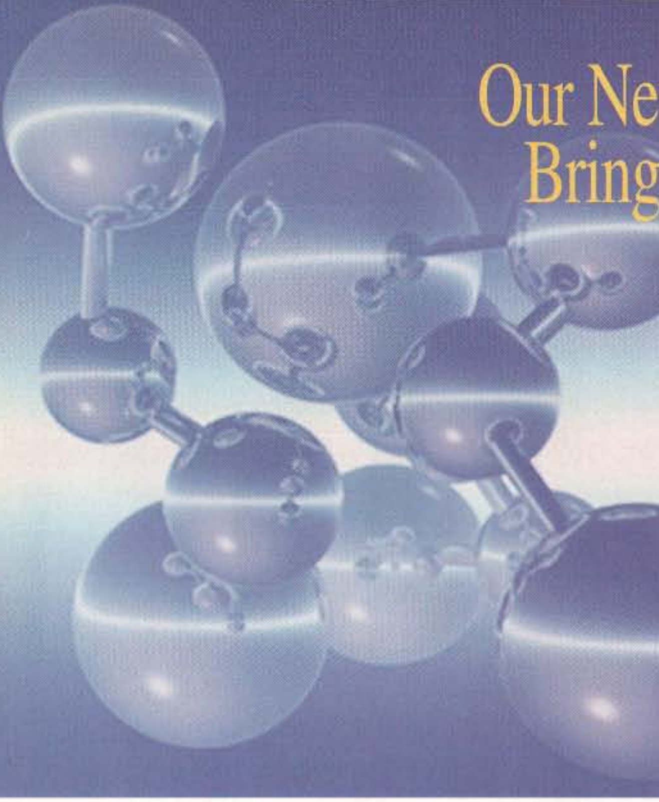

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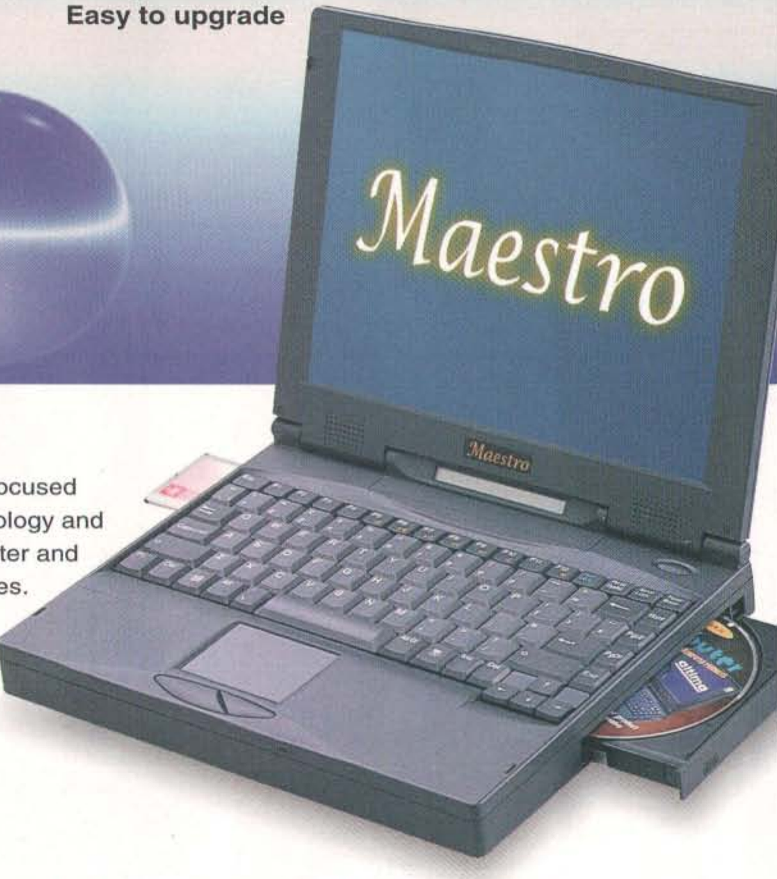

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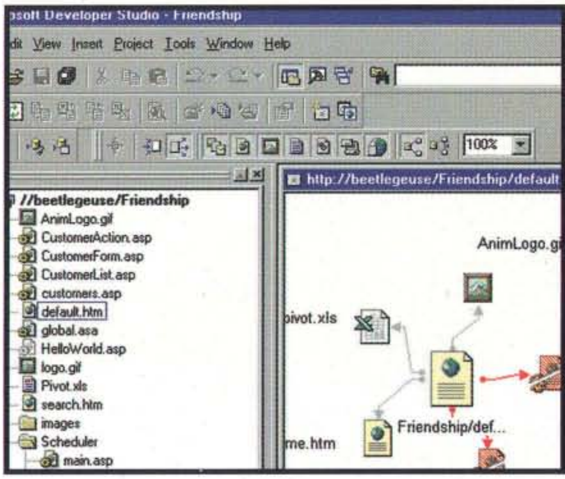

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Circle 978 on Inquiry Card.

Among Visual InterDev's many management tools is a "link view" of all your site's files.

Microsoft's new Visual InterDev is a healthy collection of tools for building and maintaining Web sites based on Active Server pages, which are both the cornerstone of Microsoft Internet Information Server 3.0 and the company's primary mechanism for delivering active content to the Web. If InterDev (formerly Internet Studio) is anything, it's at least comprehensive. Some highlights:

- Image Composer, a set of tools for creating and manipulating sprites (images that are "smart" about their shape) that you can include on your Web pages.
- Media Manager, a collection of services integrated with the Windows Explorer, that helps track the media files created as you build your Web site.
- Music Producer, which lets you pick from among several dozen music styles to create a MIDI file you can incorporate into your site.
- FrontPage 97, Microsoft's Hypertext Markup Language (HTML) editor and Web-site development tool.

In the simplest sense, an Active Server page is a file (with an .ASP extension) containing HTML and either Visual Basic script or JScript. When executed by the server, the file generates—on the fly—a virtual HTML page to be sent to the client.

RATINGS	
TECHNOLOGY	★ ★ ★ ★
IMPLEMENTATION	★ ★ ★ ★

An Active Server page can also include ActiveX controls that are downloaded and executed on the client side. However, this requires Internet Explorer 3.0, or a special Navigator plug-in offered by Netscape, on the client side.

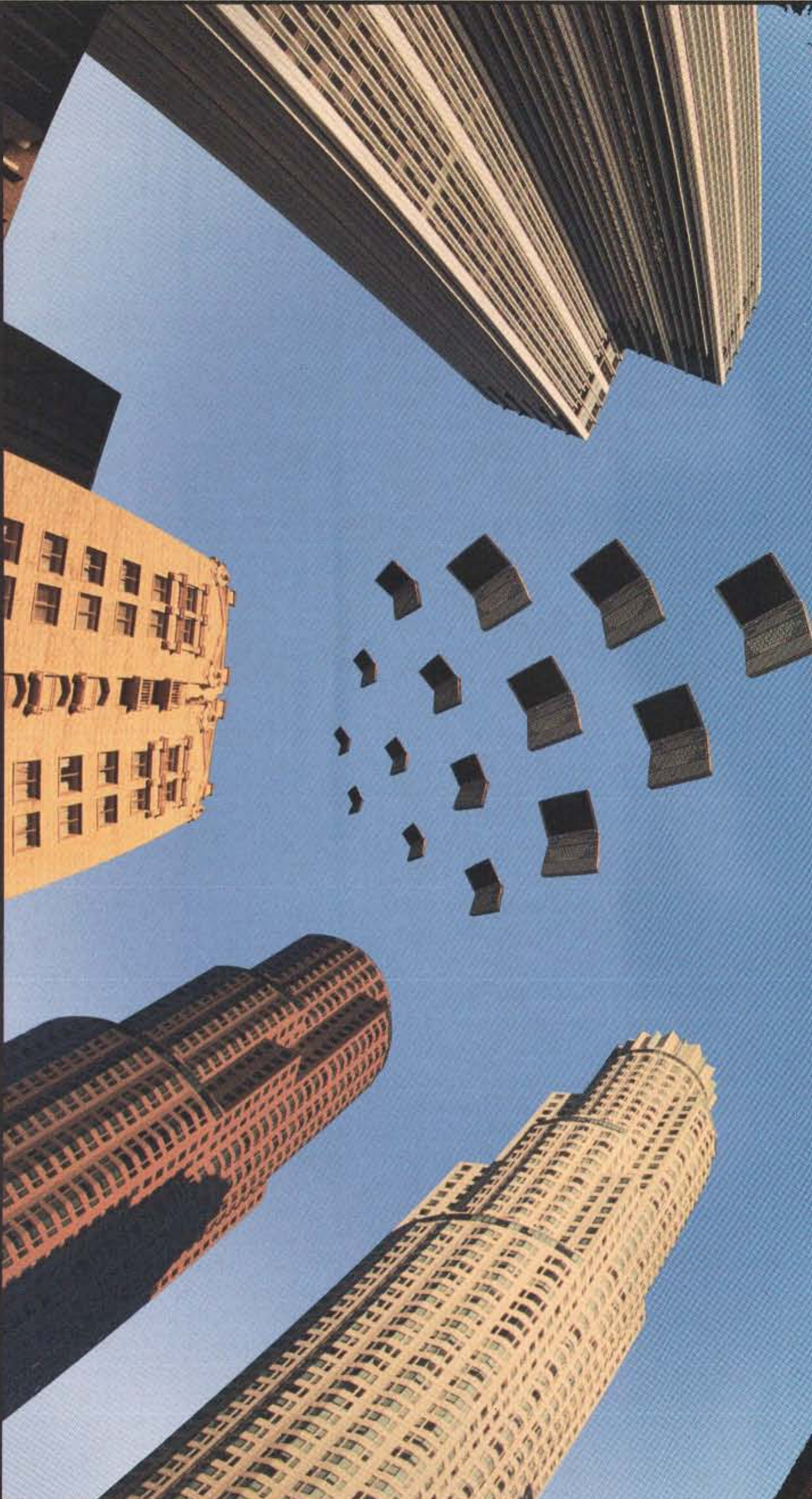
ActiveX controls play more than a client-side (run-time) role in InterDev; there are also design-time ActiveX controls that work much like wizards. Call them up while you're building your page and, through a series of guided questions, they produce the necessary script code automatically. If you embed a run-time control, InterDev's visual object editor materializes so you can modify that control's appearance and properties. The object editor then writes the appropriate HTML code to embed the control.

Another important goal of InterDev is to help designers build database activities into their Web site. (Though InterDev boasts support of any database compliant with Open Database Connectivity (ODBC), I tested it with SQL Server 6.5.) InterDev incorporates a DataView pane similar to the one in Visual C++ 4.0 Enterprise Edition—except that the InterDev version lets you modify the contents of databases, while VC++ EE's provides read-only database access. (For details about VC++ EE, see the comparison review, "Client/Server C++: Write Fast, Run Fast," on page 139.) As an accompaniment to InterDev's database support, Microsoft includes SQL Query Designer, which you can run alone or with those design-time ActiveX controls that are aware of it and that need to incorporate SQL queries.

InterDev's site management features help you keep abreast of constantly changing content. For example, a "link view" provides a graphical representation of all the links among files on your site. You can track down and patch broken links without having to spelunk your Web site for busted plumbing.

Visual InterDev's drawback is its complexity—though that's not a fault of the package as much as an indication of just how complicated a Web site can get. If you're trying to maintain a site based on Active Server pages, Visual InterDev will be your tool of choice. B

Rick Grehan is a senior technical editor for BYTE reviews. You can reach him at **rick_g@bix.com**.



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Eval

Hand-Held System

Apple's newest Newton becomes a hand-held Web browser. By Tom Thompson

The MessagePad Makeover

In its continuing efforts to carve a slice of the nascent hand-held computer market, Apple has remade its Newton technology. The result is the MessagePad 2000, which, like the latest-generation desktop computers, offers more of everything: memory (1 MB of DRAM, 5 MB of flash RAM), two Type II PC Card slots, a more powerful processor (see the Tech Focus below), a bigger display, and more software.

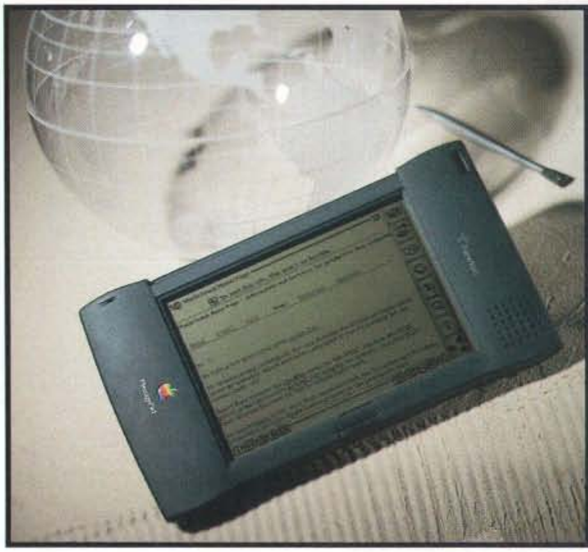
The backlit, touch-sensitive display is larger—480 by 320 pixels and 100 dots per inch (dpi) versus the MessagePad 130's 320 by 240 pixels and 72 dpi—and offers 16 gray levels. While the bigger screen makes program use (especially viewing faxes) easier, it makes the unit even bigger (4.7 by 8.3 inches) than its already rather clunky predecessor.

Perhaps the MessagePad's most interesting new feature is Newton OS 2.1's support for the TCP/IP, PPP, SLIP, PAP, and CHAP Internet protocols. Add to these the bundled NetHopper 2.0 Web browser from AllPen Software and an optional PC Card modem and you can have, at 1.4 pounds, one of the world's smallest Web browsers. I slapped in a Hayes Optima 288 PC Card modem, selected Earthlink from the Internet Setup program, typed in my name and password using the virtual keyboard, and fired up NetHopper. Total time to start surfing the Net: 5 minutes. You can have the Newton OS rotate the screen image 90 degrees to improve Web page viewing. One caveat: NetHopper currently handles only black-and-white graphics and text; a gray-scale version is in the works. For now, stick to the default, text-only display: Downloading graphics and converting them to black-and-white bit maps takes too long; worse, it often crashed my test unit. But I had no problems in text-only mode and really came to appreciate Web sites that provide text-based links.

With included spreadsheet, word processor, Web browser, and e-mail programs, the MessagePad is competitive with other hand-held computers. It supports IrDA-standard wireless infrared communication with other hand-held devices and some printers, such as HP's LaserJet 5MP and DeskJet 340. And the bundled Newton Connection Utilities software lets you keep identical notes, work files, and contact lists on the MessagePad as well as on your desktop system (Mac or Windows). The second PC Card slot means you no longer have to choose between more memory or a modem but can have both.

The MessagePad 2000—the best Newton yet—is expected to ship this quarter and sell for less than $1000. **B**

Tom Thompson is a BYTE senior technical editor and longtime Newton user. You can reach him at **tom_thompson@bix.com.**



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The MessagePad 2000's larger screen, speedy StrongARM CPU, and support for Net protocols make this the best Newton yet.

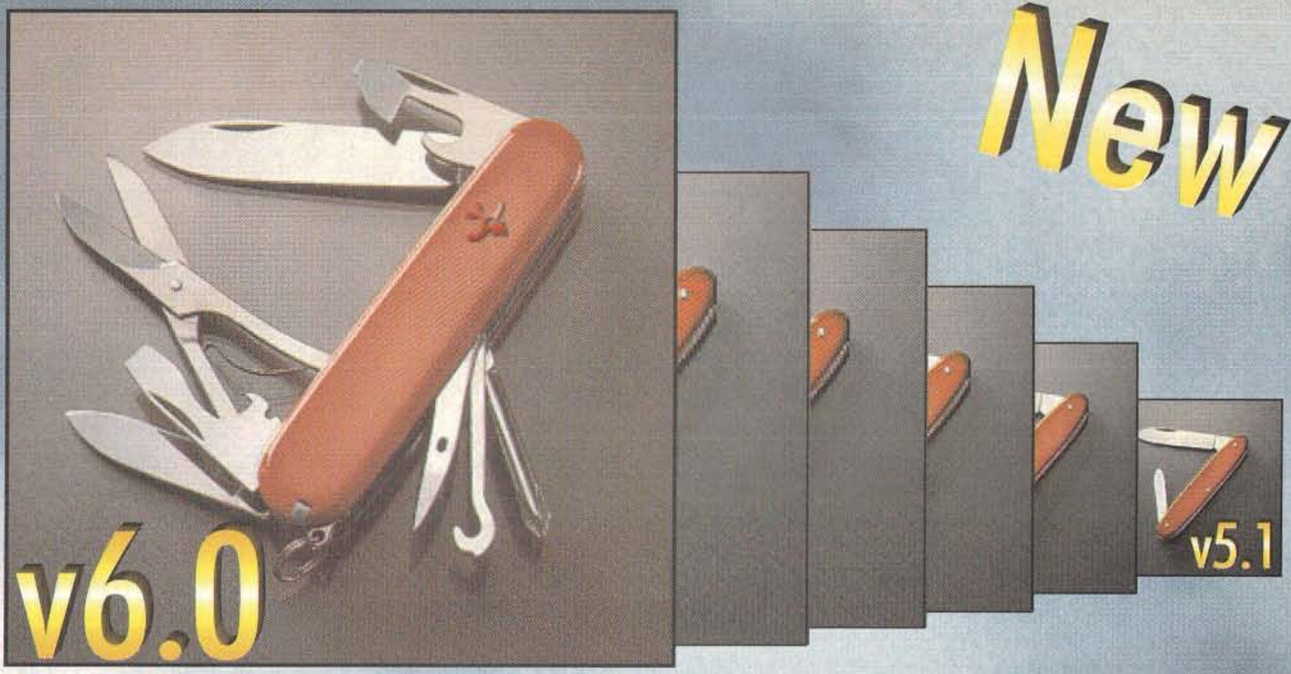
TECH FOCUS

StrongARM: Strong Brain, No Drain

The MessagePad 2000's RISC processor is Digital's StrongARM 110. The chip is clocked at 161.9 MHz—much faster than the 20-MHz ARM 610 processor in the MessagePad 130. The StrongARM 110 delivers Alpha-level computing brawn with the code compatibility and low-power appetite of the older, weaker ARM 610. Using four AA alkaline batteries, the MessagePad can operate continuously for 24 hours, Apple claims—or three to six weeks of typical use.

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★
PERFORMANCE	★★★★

PHOTOGRAPH: BRIAN WILDER © 1997



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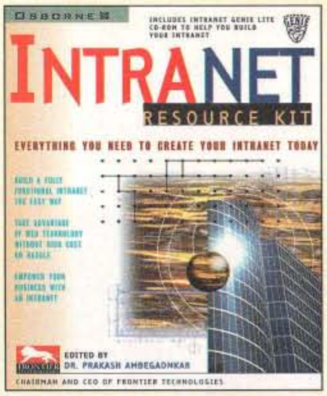
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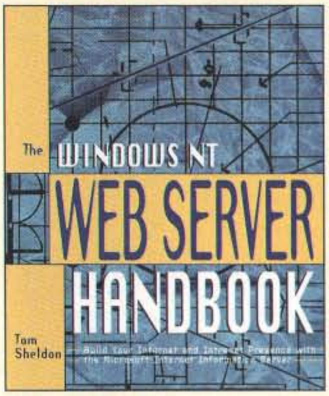

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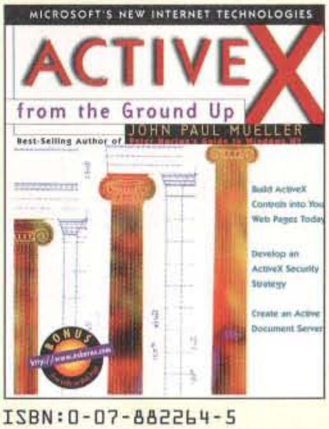
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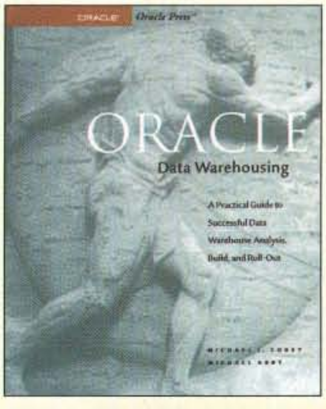
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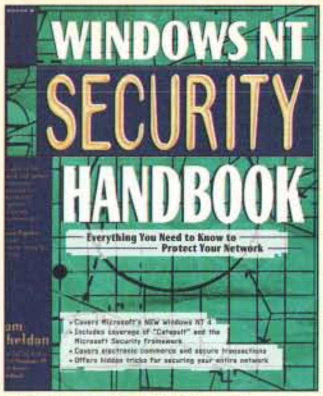

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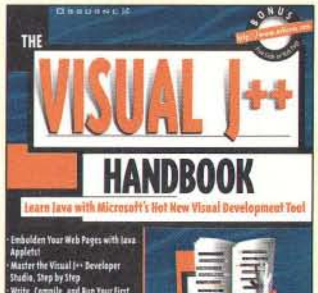

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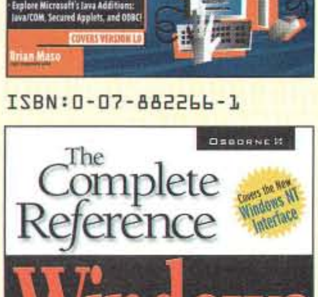
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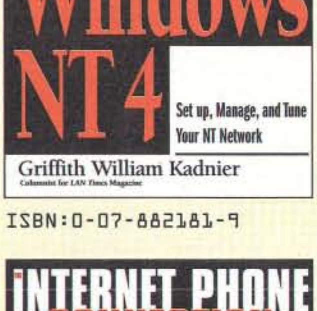
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SyQuest's latest removable-cartridge hard drive delivers excellent performance and a low cost. ***By Stan Miastkowski***

This Cartridge Is Loaded

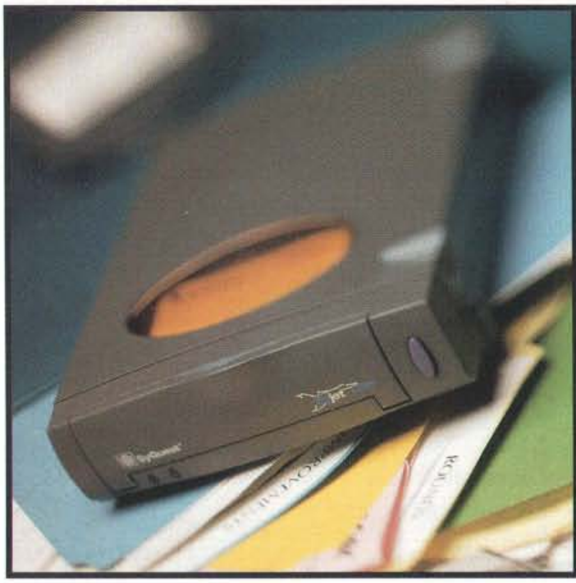
Like the seemingly perpetual battle between Microsoft and Netscape over Web browsers, Iomega and SyQuest keep upping the ante of high capacity and low cost of their removable-cartridge hard drives. The latest salvo is SyQuest's long-delayed SyJet. Originally announced as holding 1.3 GB per cartridge, shipping drives will pack 1.5 GB per cartridge (compared to the Iomega Jaz's 1-GB cartridges). With competition keeping both companies' drives and cartridges priced alike, SyQuest currently holds the technology edge.

The SyJet is available in both internal and external SCSI versions packed with software for either PCs or Macs. There's also an external parallel-port SyJet, and SyQuest says an IDE version will be available later this year. I tested a preproduction external SCSI unit, hooking it up to an Adaptec 2940 PCI controller on a 133-MHz Pentium system. For direct comparison, I attached an external Iomega Jaz to the same controller.

TECH FOCUS

Keeping It Clean

Maintaining data reliability in a high-capacity removable-cartridge drive is no easy feat, considering the microscopic tolerances involved and the lack of the factory-sealed environment found in a conventional hard drive. SyQuest handles the problem by thoroughly cleaning a cartridge when it's inserted and creating a closed filtered-air system that employs positive air pressure to keep contaminants outside the cartridge while it's running. That's buttressed with minimal moving parts to avoid contamination and materials chosen for stability. Also, when the drive is idle, the read/write heads do random "butterfly sweeps" to remove any foreign matter.



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External (shown here) and internal SyJet drives use the same 1.5-GB removable cartridge.

Using a variety of tests, including copying huge Audio Video Interleave (AVI) files and running Adaptec's SCSI-Bench, I found (not surprisingly) that the SyJet's performance was almost identical to the Jaz's. Minimum sustained transfer for both drives was 3.3 MBps; maximum was 6.4 MBps.

The SyJet is well up to tough multimedia tasks. It has a switchable audiovisual (AV) mode that turns off the drive's read verify step. This makes considerable sense for audio or video files, where a constant, uninterrupted stream of data is essential, and it doesn't matter if a few bits are dropped along the way. With AV mode turned off, the drive will do 180 retries if needed. (The Iomega Jaz also allows you to turn off read verify.)

The PC-version SyJet I tested ships with drivers for DOS, Windows 3.X, and Windows 95. There's also a simple-yet-effective backup program and a suite of utilities for formatting, copying cartridges, and setting drive parameters. The single cartridge that comes with production units will include a selection of free software, although details were unavailable at press time. Also, the SyJet has a complete and detailed manual. The Jaz has only minimal foldout sheets.

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★
PERFORMANCE	★★★★

With cartridge costs at 8 cents per megabyte (compared to 12 cents per megabyte for the Jaz), the SyJet makes storage more economical than ever. **B**

Stan Miastkowski is a BYTE consulting editor who's been poking around inside computers for almost two decades. You can reach him at **stanm@bix.com.**

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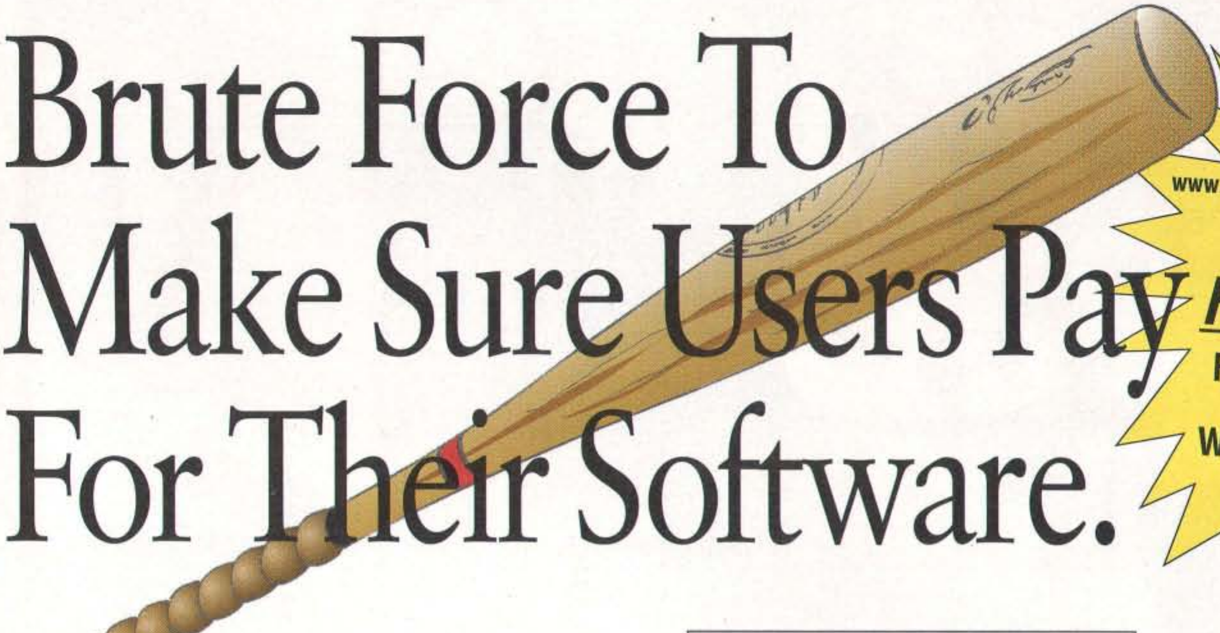

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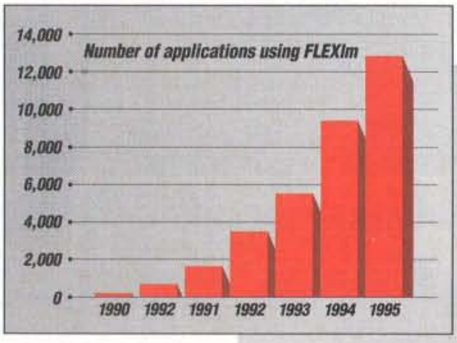

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Circle 185 on Inquiry Card.

The newest Visual Basic sibling lets you code smart and interactive Web pages. By Rick Dobson

A Visual Basic for Web Work

VBScript, which is the newest kid on the Visual Basic block, is the Web-centric dialect of Microsoft's popular visual-programming platform. It ships with Internet Explorer 3.0 (IE3), Microsoft's Web browser. VBScript can reside on Web pages and interact directly with Hypertext Markup Language (HTML). Its lightweight scripts speed downloads over the wire. By providing programming capabilities on the Web page, VBScript offers a route to smarter, more dynamic, more interactive Web experiences.

Will VBScript become a popular development platform? There are millions of Visual Basic and Visual Basic for Applications developers out there. VBScript could assist them in acquiring Web skills using familiar tools.

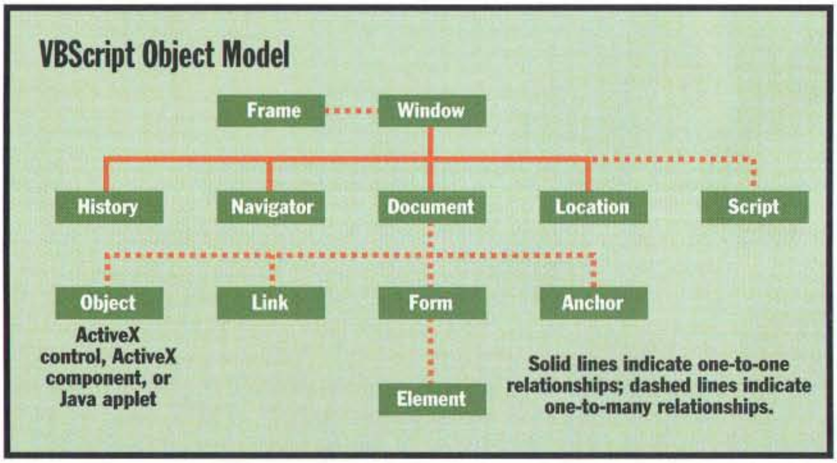
VBScript Object Model

VBScript has an object-oriented syntax. You must learn the properties, methods, and events associated with objects to become effective with this kind of platform. The figure "VBScript Object Model" presents an overview of the 11 objects in the IE3 browser. The generic "object" deals with external objects, such as ActiveX controls, Java applets, and ActiveX components. VBScript controls a session by interacting with these objects.

The window object is at the top level. Documents and all other objects in the window's immediate scope, except for frames and scripts, have a one-to-one relationship with the window object. Frames sit in windows but are themselves windows. Any one window can have multiple frames. Your VBScript code sits on a Web page in a script object.

Object events offer hooks that let you invoke scripts. For example, you use the `onLoad` window event to perform functions that need to take place when a window opens. The corresponding `onUnload` event lets you execute cleanup functions before a page exits a browser.

A document object's properties and methods pertain to the current Web page. For example, the `bgColor` and `fgColor` properties let you read and change the background and foreground colors of the current page. You must use prefix references for documents (and for all other objects, except windows) in VBScript. Document methods, such as `write`, must be prefaced with their antecedent (e.g., `document.write string` writes the contents of `string` to the screen).


VBScript Object Model
Frame
Window
History
Navigator
Document
Location
Script
Object
Link
Form
Anchor
ActiveX control, ActiveX component, or Java applet
Element
Solid lines indicate one-to-one relationships; dashed lines indicate one-to-many relationships.

VBScript uses these objects to manage and control a Web session.

Forms, links, anchors, and general objects that are outside the scope of IE3 reside in documents. Each document can have many of these. Each form, in turn, can have more than one element, such as a button. Scripts reference most of these objects through their name attribute. For instance, `Document.NameOK` refers to a form that has a name attribute of NameOK. When dealing with ActiveX controls, Java applets, and ActiveX components, you instead use the id attribute to reference these objects.

VBScript Programming Techniques

The "Code Exhibit" section presents a series of four examples that illustrate object-oriented style with VBScript. Visual Basic developers will instantly notice the resemblance between VBScript and their current development environment.

I start with the classic "Hello World." The document's write method normally inserts a string on the page. In this instance, its argument is an expression based on the `For` loop's index. Each pass through the loop evaluates the expression for a different index that sets the font tag's value. The `writeln` method on the loop's second line includes the "Hello World" message. This method causes the line to advance after writing to the screen. You must surround your code with the tags `<PRE>...</PRE>` to have preformatted text displayed "as is" for the line-advancement feature to work.

The second example shows how to use buttons to control hyperlinking. Several lines at the bottom of the fragment create

Code Exhibit

Example 1: Object model writes dynamically

```
<HTML>
<PRE>
<SCRIPT language="VBScript">
'Progressively larger message
For I = 3 TO 6
 document.write("<FONT SIZE = "&i&">")
 document.writeln("Hello World.")
Next
</SCRIPT>
</PRE>
</HTML>
```

Example 2: Hyperlinking button

```
<HEAD>
<SCRIPT LANGUAGE="VBScript">
Sub button1_onclick
 location.href = "http://www.byte.com/"
end sub
</SCRIPT>
</HEAD>
<BODY>
<FORM>
<input type="button" value="Go to Byte"
 name="button1"></FORM>
</BODY>
```

Example 3: Clean data locally

```
<SCRIPT LANGUAGE="VBScript">
Sub cmdSubmit_OnClick
 Dim frmForm
 Set frmForm = Document.NameOK
 If frmForm.txtText1.Value = "" Then
   MsgBox "Type your name first."
 Else
   frmForm.Submit
 End If
End Sub
</SCRIPT></HEAD>
<BODY>
<FORM NAME="NameOK">
Enter your name:
<INPUT NAME="txtText1" TYPE="TEXT" SIZE="25">
<INPUT NAME="cmdSubmit" TYPE="BUTTON" VALUE="Submit">
</FORM>
```

Example 4: Animate a page

```
<OBJECT>
 classid="clsid:59CCB4A0-727D..."
 id=timer1 align=middle>
  <param name="Interval" value="1000">
  <param name="Enabled" value="True">
</OBJECT>
<SCRIPT LANGUAGE="VBSCRIPT">
Sub timer1_timer
If Label1.Caption <> "Byte" Then
  Label1.Caption = "Byte"
  Label1.BackStyle = 1
  Label1.ForeColor = 16777215
 Else
  Label1.Caption = "Gotta have it"
  Label1.BackStyle = 0
  Label1.ForeColor = 0
 End If
End Sub
</SCRIPT>
```

the button. The button appears on the screen with the caption "Go to Byte." The button's name attribute is `button1`. I use an event procedure to invoke the hyperlink. A two-part name identifies this kind of procedure: `objectname_eventname`.

When viewers click on the button, they generate the `onclick` event. This in turn launches the `button1_onclick` procedure. The location object in this procedure represents the current uniform resource locator (URL). The assignment line reevaluates the `href` property for the location object so that it launches the jump to the URL (in this case, the BYTE Site). The assignment feature lets you dynamically change hyperlinks in response to user choices.

The third code segment demonstrates how to clean data locally through a client-side script. This can reduce bandwidth use and improve performance. A user enters his or her name in a text box and then clicks on a button to submit the form. In a real application, the form object would have action and method attribute settings that describe its function. The button's type attribute is not `submit`, but `button`. If I used a type of `submit`, the form would go to the server without the opportunity for it to be intercepted with a local procedure. The event procedure `cmdSubmit_onclick` reminds the user to enter a value into the name field if he or she clicks on the button without entering one. If the data is valid, it passes it on the server with the form's `submit` method.

My final example illustrates the building of animated Web pages with VBScript. The script toggles two images. One image shows "Byte" in white letters on a black background. The other presents "Gotta have it" in black letters on the Web page's background. VBScript accomplishes this feat with the aid of the Microsoft label and timer ActiveX controls. Both controls are available free at the ActiveX Web gallery (http://www.microsoft.com/activex/gallery/).

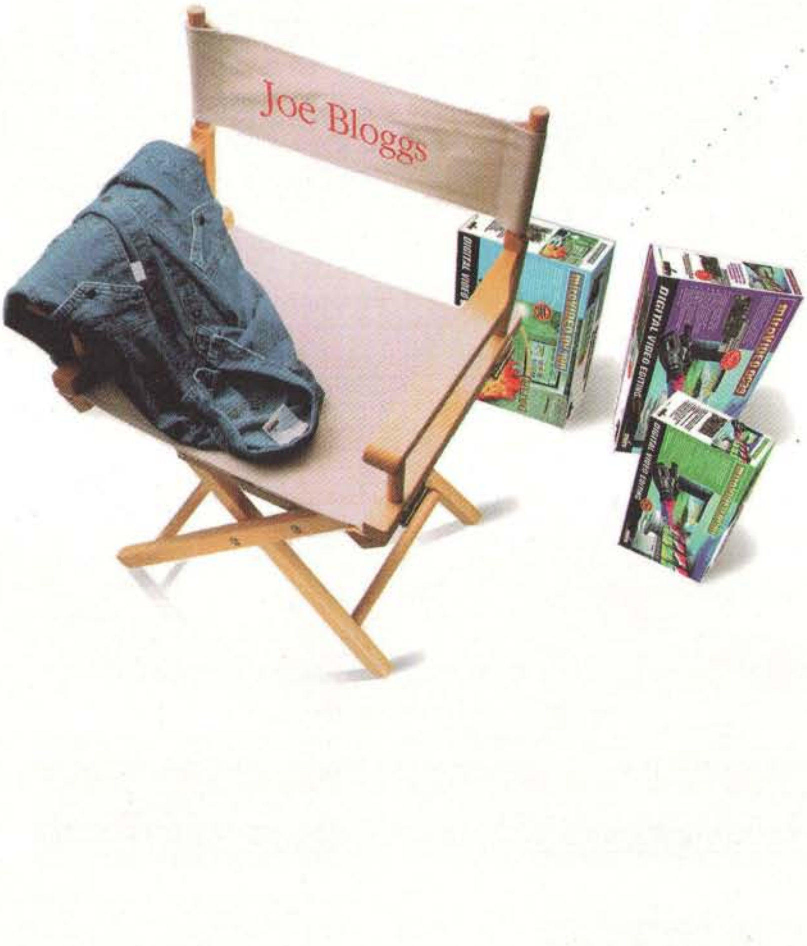
The snippet shows the code for the timer control. You first bracket all references to ActiveX controls with the `<OBJECT>...</OBJECT>` tag pair. Use the `param` tags to make design-time property settings for the object. The label control code has the same structure as that of the timer with its own `classid`, `id`, and `param` settings. The procedure in the example fires when the timer event occurs, once a second. An `If...Then...Else` statement toggles the attributes. The current value of the label's caption property determines whether the label receives the settings for one image or the other.

Where Do You Go from Here

If you are like me, you will decide that for VBScript, you gotta have it. If you know either Visual Basic or Visual Basic for Applications, and you want to do custom Web applications for folks browsing with IE3, you will almost surely use it. IE3 is available for Windows 95/NT, Mac, and Windows 3.1 computers, and Microsoft has plans to deliver it to Unix. As of this writing, Microsoft has a beta Web server that lets you program ActiveX content with VBScript. All this will widen the opportunities to use your VBScript skills.

Download a copy of IE3 with VBScript from http://www.microsoft.com/ie/ and visit http://www.microsoft.com/vbscript/ to get the documentation. For a complete list of the IE3 objects, properties, methods, and events, you can go to http://www.microsoft.com/intdev/sdk/. B

Rick Dobson is president of CAB, Inc., a database and Internet development consultancy. His byline appears in numerous magazines. You can contact him at **Rick_Dobson@msn.com.**



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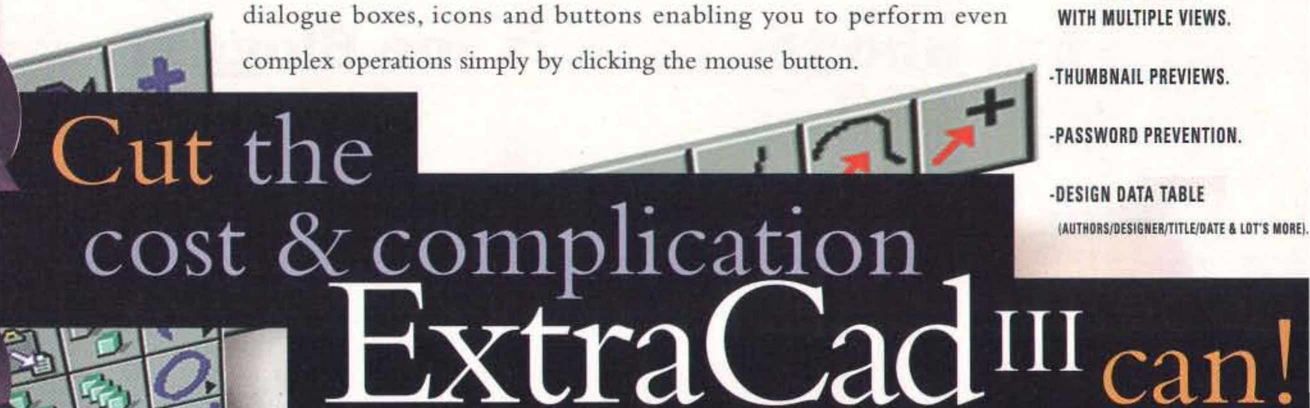


This set of free Unix utilities lets Windows clients access Unix servers. ***By Tom Yager***

Unix and Windows Dance the Samba

Microsoft's various versions of Windows have brought us as close to universal interoperability as we've ever been. The only problem with this otherwise appealing situation is that the key Microsoft file and printer sharing protocol—Server Message Block, or SMB—is viewed as proprietary. Ergo, it's commonly believed that SMB is implemented only in Windows.

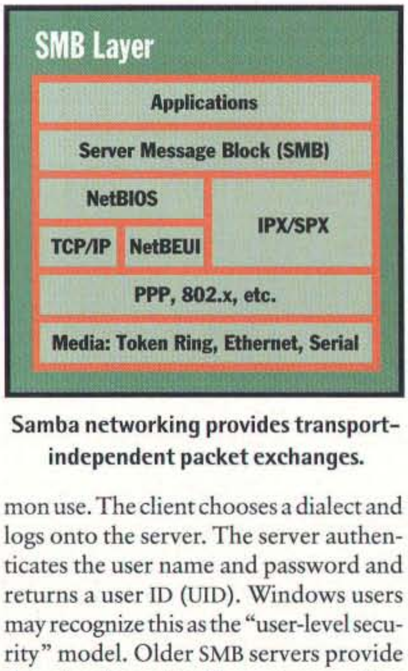
Although Microsoft and Intel developed SMB, it is not proprietary. Microsoft has provided the SMB specification to The Open Group (formerly X/Open), and there's a lot of vendor support for the Common Internet File System (CIFS) standard, which is an enhancement of SMB. SMB is so well and so widely documented that any programmer with enough patience and skill can implement an SMB server to which any Windows system can connect.

Andrew Tridgell did just that. He developed Samba, a well-respected suite of free software components that implement an SMB server on a Unix system. After you install and configure Samba, every Windows for Workgroups, Windows 95, Windows NT, OS/2, and DOS system will see your Unix host's files and printers. Samba is truly free and truly useful, a combination that's sadly rare in the Windows world.

What's an SMB?

The Server Message Block protocol provides transport-independent file and printer sharing, user authentication, and interprocess communications (IPC) services. You can send SMB packets over every transport that Windows supports natively. Today, that's TCP/IP, Novell's IPX/SPX, and Microsoft's NetBEUI. Transport independence means SMB is media-independent, also: SMB works as well on Ethernet or Token Ring, and it can ship packets across WAN connections, too.

The figure "SMB Layer" shows where SMB fits with other networking components. It's a software layer that spares you the mechanics of accessing network services through a particular protocol. SMB boils network resource-sharing operations down to a simple set of packet exchanges. A client wanting to access a file, print, or IPC resource on a server first queries the server for supported SMB dialects. There are at least 10 dialect variants, but only three or four are in common use. The client chooses a dialect and logs onto the server. The server authenticates the user name and password and returns a user ID (UID). Windows users may recognize this as the "user-level security" model. Older SMB servers provide share-level security. Here, you can assign a password to a resource, but there's no concept of users. Everyone accessing the resource supplies the same password. More recent SMB servers, like those that are implemented in Windows NT and Windows 95, support both share- and user-level security models. User-level security is preferable because you can control a user's access to an entire network from a single host.



Samba networking provides transport-independent packet exchanges.

The rich SMB protocol includes commands for checking print queues, manipulating files and directories, and locking files and ranges of bytes in files. An application written with SMB alone would sport an impressive array of networking capabilities.

SMB for Unix

There's more than one way to get SMB onto a Unix system. Microsoft got involved in the effort years ago, working with AT&T to develop LAN Manager for Unix (LM/X for short). This ported version of Microsoft's stand-alone network OS became the foundation for many commercial Unix SMB servers. SCO has the most visible commercial solution in its VisionFS product. This SMB server is graced with a point-and-click administrative interface, making it somewhat easier for Windows users to administer Unix SMB resources. VisionFS costs $125 for the first user, and then $82.50 for each additional user.

Samba, on the other hand, costs you nothing but time. The Samba Web site (see http://samba.canberra.edu.au/pub/samba) contains pointers to Samba binaries for every conceivable version of Unix. In keeping with the Gnu tradition, the source code is always available.

When I picked up the binaries, I also grabbed the source code. One set of source files is provided for each new release of Samba. I installed the source on my UnixWare 2.1 system and gave it a quick compile. You build Samba for your flavor of Unix by removing the comments from the appropriate lines in the make file. After starting the make, the compiler spat out volumes of warning messages, but it produced a perfectly usable set of binaries. Samba runs entirely as user processes. There are no device drivers or kernel extensions to manage. This is both boon and bane: It makes for an easy installation, but it leaves Unix applications unable to deal with SMB (clients or servers). It also imposes a performance penalty since Samba must wade through Unix API layers to get the file I/O done. Some commercial implementations address this performance problem. SCO claims a nearly 2-to-1 speed advantage for its VisionFS over the regular Samba.

Several of Samba's key operational parameters are compiled into the binaries. That includes the location of the smb.conf file. The contents of this file tell Samba what to share and how to share it. Getting started with Samba requires only a one-line smb.conf:

```
[homes] writable = yes
```

With this, Samba will provide user-level access to every user in your Unix host's /etc/passwd file. The `[homes]` entry is actually a template. Every time a validated user attempts to access the server, Samba creates a resource matching the user's name. The resource serves up the user's home directory.

The documentation that comes with Samba includes exhaustive coverage of smb.conf options. Actually, the *options* are exhaustive. The smb.conf manual page lists more than 120 parameters. The sidebar "Ways to Samba" (below) covers just a few of these many parameters.

Samba is more flexible than Windows NT in some ways, allowing you to tune it to respond differently to requests from specified users and machines. Some parameters like "debug level" affect all Samba sessions. Others are share-specific, letting you restrict access, change the rules for mapping long filenames to short filenames, and set default permissions for new files. A sample smb.conf, loaded with comments, is provided for boilerplate editing. Anything more than casual use of Samba calls for a thorough understanding of the documentation.

Samba Server

The Samba SMB services are provided by a pair of daemons: `smbd` and `nmbd`. The SMB server proper is `smbd`. It listens for client requests on TCP port 139. You can start it at boot time by adding it to rc.local (or its equivalent) or by placing entries in /etc/services and /etc/inetd.conf. In my tests, I developed a preference for starting `smbd` at boot time. That way, clients can see published shares as soon as the Unix host is fully up. Otherwise nothing is visible until the first client makes a request.

If smb.conf is filled in and placed in the proper directory, launching `smbd` with the `-D` option (daemon flag) will get SMB services rolling. It runs silently, but if you specify a debug level or a log file, you'll see messages produced by `smbd` as it runs.

The other daemon, `nmbd`, is a Windows Internet Naming Service (WINS) server for Unix. It listens for WINS queries and feeds them to your Unix host's name-resolution mechanism. You can use a Unix host running `nmbd` as your network's primary WINS server.

Who Needs It?

Samba isn't for everyone. There's nothing friendly about Samba's administrative interface (what interface?). Even a Unix veteran will find the mishmash of smb.conf parameters daunting. What's more, file and print services are the core of a LAN's essential nature. While I encountered no problems with Samba except performance, I'd be hard-pressed to advise a client to rely on it as a primary server.

Samba is, however, delightfully useful for two purposes. First, it provides an easy, inexpensive means of giving Windows users access to Unix files. Without Samba, users must resort to FTP or costly NFS client software to pull files from a Unix host. With Samba, access from Windows clients is effortless and requires no additional software (except TCP/IP for Windows for Workgroups clients, which is also free).

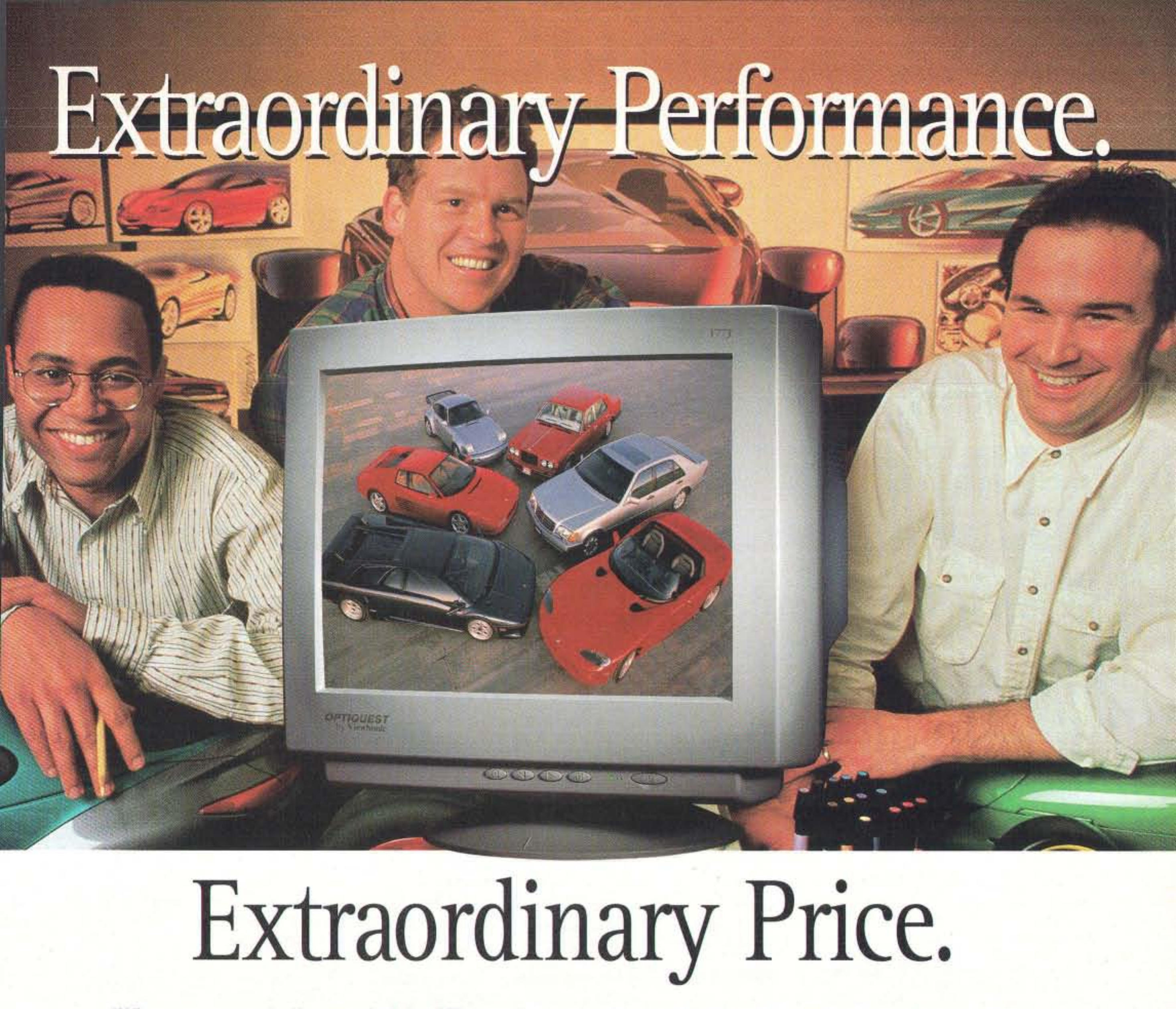
The second purpose came as a surprise to me. Because you have access to the source code, and because the Samba distribution includes a client test utility (smbclient), you can use the Samba suite to diagnose and tune up an SMB network. Higher debug levels produce mountains of messages, some useful, some not, but Samba does not try to conceal anything. After installing and running Samba, you will have more than Windows access to your Unix files. You'll have vital tools for diagnosing and fixing SMB network problems. And you'll have an understanding of Microsoft networks the likes of which can't be delivered by Windows' on-line help. **B**

Tom Yager is a senior software developer for TTG in Dallas. He operates a private test lab where he researches networking, OS, software development, and multimedia technology. You can reach him at **tyager@maxx.net.**

Ways to Samba

While a few options are compiled in, most of Samba's behavior is determined by the contents of the smb.conf file. Listed below are some of the most important options; refer to the Samba manual pages for more information.

- **admin users:** grants unrestricted access to named users
- **hosts allow/deny:** admits or excludes hosts, workgroup members, or IP address ranges
- **dead time:** number of idle minutes before Samba disconnects session
- **guest account:** Unix user name set aside for guest access
- **log file:** name of file that captures debug output
- **debug level:** higher numbers deliver more detailed information
- **mangled map:** maps Unix names to DOS equivalents (e.g., *.html to *.htm)
- **postexec:** runs a command when user detaches from a share
- **preexec:** runs a command when user attaches to a share
- **preserve case:** maintains the case of Unix filenames
- **print command:** sends queued files to a Unix printer
- **read/write list:** listed users are given read-only or read/write access
- **remote announce:** announces a Samba server to a specific LAN or host
- **sync always:** sets all writes to be synchronous or asynchronous
- **username map:** maps Windows names to Unix equivalents



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Proper understanding and use of the PowerPC's on-chip caches can improve an application's performance. **By Mike Phillip**

Zen and the Art of Cache Maintenance

The growing disparity in clock speeds between the processor and DRAM, combined with an increasing degree of processor superscalability, has made effective cache management a critical factor in obtaining optimal application performance. With main memory access now taking anywhere from tens to hundreds of CPU clock cycles, the difference between finding desired code or data in the on-chip cache instead of in main memory can completely dominate the effective speed of an application, or even an entire system. As a developer, there are a variety of techniques available that let you more effectively make use of the processor caches.

Dealing with Data

Often the biggest factor in data cache management is how an algorithm accesses its data. Since maintaining locality in data references (that is, accessing memory whose addresses are adjacent or close together) is critical to maximizing cache performance, structuring program code with the memory system in mind often pays big performance dividends. The programmer can use a couple relatively simple strategies to improve performance.

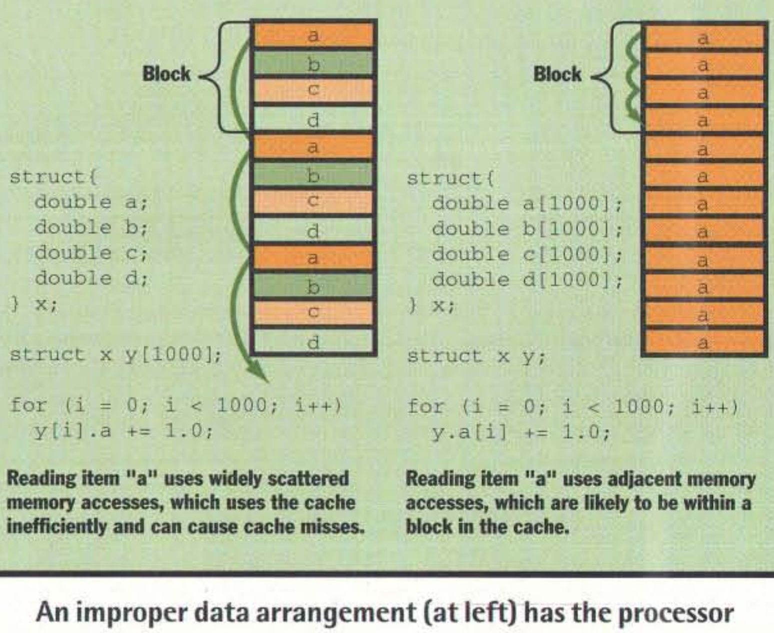
The first strategy involves data layout. Decisions regarding the organization of aggregate data structures often have a significant impact on data cache utilization. For example, whether you define an array of 100 structures versus a single structure whose members are each 100-element arrays can literally double or triple the attainable bandwidth of the data cache, depending on the data access patterns of the application. As the figure "Data Organization Boosts Performance" shows, an array of 100 structures can scatter data accesses throughout main memory, causing frequent flushing and reloading of the cache. A structure with 100-element arrays has these items occupying adjacent addresses, so any references to them will probably find the items in the cache.

The second strategy is to make use of processor-specific features. Most modern microprocessor instruction sets provide a mechanism for managing the data cache under software control. The PowerPC architecture contains several user-accessible instructions for manipulating the data cache that can significantly improve overall application performance (see the table "Data Cache Instructions").

It's important to define what a *block* is in this context. A block is the fundamental unit of memory that the cache works with. The cache handles all memory loads and stores using blocks. Block size can vary from processor to processor. For example, the PowerPC 601 uses 64-byte blocks, while the 603 and 604 use 32-byte blocks.

Each of these instructions operates on a pair of general-purpose register operands, whose sum forms the effective address of the memory location(s) to be affected. The "block touch" (`dcbt`) and "block touch for store" (`dcbtst`) instructions are essentially hints to the processor that the addressed data block is to be loaded, or at least allocated, in the data cache. When placed appropriately ahead of the anticipated need for data from memory, the `dcbt` instruction can be used to bring data from memory (or a secondary cache) into the primary data cache, thus dodging the performance hit of a cache miss. The `dcbtst` instruction behaves in a similar manner except it gives the processor the additional hint

Data Organization Boosts Performance



```
struct{
  double a;
  double b;
  double c;
  double d;
} x;

struct x y[1000];

for (i = 0; i < 1000; i++)
  y[i].a += 1.0;
```

Reading item "a" uses widely scattered memory accesses, which uses the cache inefficiently and can cause cache misses.

```
struct{
  double a[1000];
  double b[1000];
  double c[1000];
  double d[1000];
} x;

struct x y;

for (i = 0; i < 1000; i++)
  y.a[i] += 1.0;
```

Reading item "a" uses adjacent memory accesses, which are likely to be within a block in the cache.

An improper data arrangement (at left) has the processor flushing and reloading its on-chip caches.

that the corresponding memory location is going to be overwritten soon. Since the `dcbt` and `dcbtst` instructions do not actually modify memory (that is, they affect the contents and state of the data cache itself), there are no exceptions taken if the address translation fails. If the requested block already resides in the data cache, these instructions are treated as no-ops by the processor.

The "block flush" (`dcbf`) and "block store" (`dcbst`) instructions force modified (or dirty) data out of the cache and back into memory. The primary difference between these two instructions in uniprocessor mode is that `dcbf` not only copies data back to memory (as does `dcbst`), it also marks the corresponding cache block as invalid. Since both of these instructions can change data in memory, exceptions related to address translation are handled the same as they would be for a normal load instruction from the addressed memory location.

Perhaps the most unusual of the data cache manipulation instructions in the PowerPC architecture is "block set to zero" (`dcbz`). The `dcbz` instruction allocates a block of data in the cache and then initializes it to a series of zeroes; thus, it modifies data in the cache. The `dcbz` instruction can be a very powerful means of boosting performance when zeroing a large block of data. It also can lead to nonportable code if care is not taken. Since not all implementations of the PowerPC have the same data cache block size, the amount of memory actually zeroed using the `dcbz` instruction may vary from one processor to another. Thus, if you wish to zero a fixed-size data array, the number of `dcbz` instructions required varies between processors of differing cache block sizes. However, the cache block size can be determined once per application launch, prior to the first use of the `dcbz` instruction. A function similar to the pseudocode in the listing "Measuring Block Size" measures the data cache block size for PowerPC processors.

Data Cache Instructions

`dcbf`	`rA,rB`	**data cache block flush**
`dcbst`	`rA,rB`	**data cache block store**
`dcbt`	`rA,rB`	**data cache block touch**
`dcbtst`	`rA,rB`	**data cache block touch for store**
`dcbz`	`rA,rB`	**data cache block set to zero**

Instruction Impact

The instruction cache is often overlooked by programmers as a source of performance improvement, even though every executed instruction passes through this potential system bottleneck. Traditional compiler code optimizations such as function inlining and loop unrolling are frequently cited as a means of improving performance by exposing additional information to the compiler optimizer. However, if not used carefully, such transformations can have an impact on instruction cache performance by reducing the locality properties in the program code.

One means of getting the benefits of function inlining while avoiding lost instruction cache locality is to use profiling-directed feedback. This feedback guides the compiler in selecting only those performance-critical functions to be transformed into inline code. Profiling-directed feedback involves a two-step compilation process in which an application is first built with special instrumentation code that keeps track of where dynamic execution time is spent. Executing the instrumented application automatically gathers profiling statistics for one or more invocations of the application. This profiling data is fed back into the compiler during a second compilation of the application, where it inlines key functions at only those sites where they are called frequently.

The profiling data also permits the compiler to rearrange basic blocks so that infrequently executed code gets moved to a different range of addresses than the most frequently executed code. For example, consider error-checking code: It is necessary to ensure an application's robust operation, yet it is rarely executed. Such code is often offset from the main flow of execution by a conditional language construct, such as a C `if` statement. The compiler can relocate such basic block(s) representing the body of the error-checking code elsewhere so that the main body of code can occupy the instruction cache.

The benefits of such an approach are applicable to a wide range of programs, particularly those in which execution time is not spent primarily within a few small program loops. Consider the speedups obtained using a combination of basic block restructuring and cross-file function inlining for some well-known C applications that are part of the SPEC95 benchmark suite. The Gnu C compiler (gcc) and a Lisp interpreter (li) obtained speedups of greater than 20 percent when profiling-directed feedback was used to guide function inlining and basic block placement. Two other applications, an instruction-set simulator (m88ksim) and an object-oriented database transaction benchmark (vortex), each obtained speedups better than 10 percent. **B**

Mike Phillip is manager of PowerPC Compiler and Tools Development for Motorola. He can be reached at **phillip@risc.sps.mot.com.**

Measuring Block Size

```
/*
* Assumes mem[] is aligned on 256-byte boundary within a page,
* and that 4 <= block_size <= 256 bytes as a multiple of 4
bytes.
*/
/* Set a 256 byte block of memory to all 1's */
   for ( i = 0: i < 64; i++ )
     mem[i] = 0xffffffff:
/* Execute a dcbz instruction at location mem[0] */
   __dcbz (mem, 0);
/* Place a "guard word" of 1's at end of 256-byte block */
   mem[64] = 0xffffffff;
/* Look for first non-zeroed word */
   for ( i = 0: mem[i] == 0; i++ )
     /* empty loop body */ ;
   block_size = i * 4;
```

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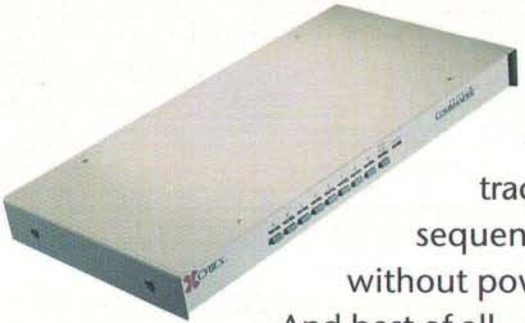

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How to write code that interacts with Netscape while extending its capabilities. By Andrew Taylor and Raymond GA Côté

Enhancing Netscape with Plug-Ins

In this article we present a short excursion into the Macintosh LiveConnect plug-in software development kit (SDK) for Netscape Navigator 3.0. We modify the sample applications provided in the SDK, connect a third-party graphics library from Snowbound Software, and point out a few pitfalls for the unwary. The final result is a plug-in that allows you to display PCX files on the Mac and perform the simple manipulations of rotating and resizing images.

Your First Plug-In

The Netscape plug-in SDK is available free of charge from the Netscape Web site at http://home.netscape.com/comprod/development_partners/plugin_api/index.html. It contains projects for Mac, Windows, and Unix machines.

The SDK is simple to use and quick to implement, but, unfortunately, it's the source of some maddeningly obscure problems. All the SDK sample projects were built using Metrowerks CodeWarrior release 9. We made all modifications to the `MacShell.cpp` file, which is one of the source files in the project.

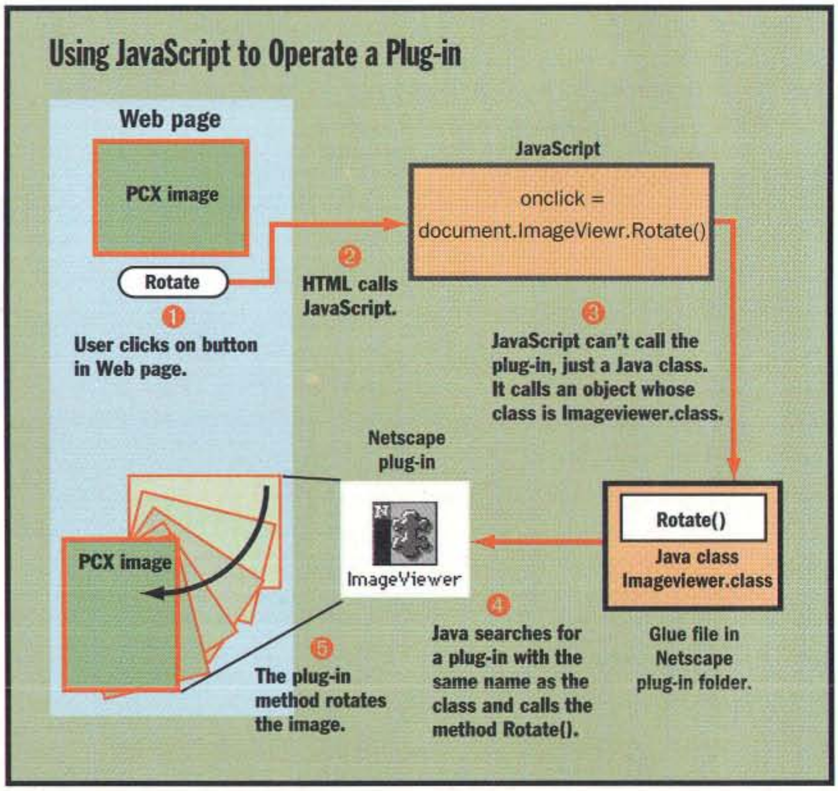
Navigator presents data to a plug-in in one of two formats: stream and file. The *stream* data type allows the plug-in to operate on data as it's downloaded from the network. The *file* data type indicates that the plug-in wants to see the entire file before processing. The imaging library we use prefers to process complete files, so we'll concentrate on that method.

Modifying the MacTemplate project code is simple and obvious. The steps are outlined below.

First, declare an image-handle variable (`fImgHandle`) for storing the decompressed image. Second, initialize this new variable by setting it to –1 during the call to `NPP_New`. Third, clean up the memory by releasing any allocated memory during `NPP_Destroy`.

In the fourth step, add the following line to `NPP_NewStream` to inform Navigator you want a file, not a stream:

```
*stype = NP_ASFILEONLY; // we
    are file-oriented
```



Using JavaScript to Operate a Plug-in

Web page
PCX image
Rotate
① User clicks on button in Web page.
② HTML calls JavaScript.
JavaScript
onclick = document.ImageViewr.Rotate()
③ JavaScript can't call the plug-in, just a Java class. It calls an object whose class is Imageviewer.class.
Netscape plug-in
ImageViewer
Rotate()
Java class Imageviewer.class
Glue file in Netscape plug-in folder.
④ Java searches for a plug-in with the same name as the class and calls the method Rotate().
⑤ The plug-in method rotates the image.
PCX image

How events flow from JavaScript to a Netscape plug-in.

Step five is where all the difficult work comes in. In the call `NPP_StreamAsFile`, add the lines shown in the first section of the table "Code Gallery" on page 64 to decompress and display the image. When the Web page references a uniform resource locator (URL) on a remote Web page, Navigator first downloads the image into a temporary file and then hands you the name of the temporary file. Navigator automatically deletes this image file when it's no longer needed.

In the final step, change the `DoDraw` call to display the image. Navigator provides several things: a pointer to the graphics port for display, the origin within the port, and the height and width of the image. The Snowbound library scales the image to fit within that viewing area.

Then you build the project. The resulting shared library (for PowerPC) or code resource (for 680x0) is ready to test.

The plug-in resulting from the preceding six modifications displays a PCX image directly in a Web page. But the image may look rather strange. The reason for this took a little while for us to discover and was the subject of our first lesson about plug-ins.

Code Gallery

Section 1: Display a graphic

```
// The following line calls the Snowbound library to do
// all the decompression work.
This->fImgHandle = IMG_decompress_bitmap((char *)fname);

// Display the image.
if( StartDraw(This->fWindow))
{
     DoDraw(this);
     EndDraw(This->fWindow);
}
```

Section 2: Call the Rotate method

```
 // get plug-in structure back for this instance.
NPP instance = (NPP)self->GetPeer(env);
// retrieve pointer to the actual instance.
ImageViewer *iView = (ImageViewer *)instance->pData;
// Now able to use object methods and variables.
// Invoke the rotate method.
iView->Rotate();
```

Mixed Lessons

Lesson one: Never trust the state of the world. Implementing a simple image-decompression/image-display plug-in took three calls and just minutes. Unfortunately, the displayed colors bore little resemblance to the way that the Snowbound library usually displays the image.

It turns out that Netscape changes the window's foreground and background colors. Adding a call to save the `GrafPort` settings, forcing them to known values, and then restoring the original settings when done solves this problem.

Lesson Two: Use minimal code to paint. Your plug-in might receive an update event multiple times when you think one would be sufficient. Just make sure you don't do a lot of calculations in your paint routine. Simply updating the display from an off-screen bit map is probably optimal.

Lesson Three: When debugging, debug the right code. Debugging a plug-in (in our case, a PowerPC plug-in) is fairly simple. Just follow the steps below.

- Quit Netscape Navigator. This is *very* important. You can spend a remarkable amount of time debugging the wrong version of the plug-in because Navigator cached the previous version.
- Drag an alias of your plug-in into the Netscape Plug-Ins directory.
- Set up your debugger to break on the `NPP_Initialize` call.
- Launch Navigator and open a Hypertext Markup Language (HTML) page, which exercises your plug-in.

JavaScript Makes It Live

Adding a new display ability to Navigator is useful, but the combined power of JavaScript, Java, and plug-ins provides the ability to also interact with the plug-in directly on the Web page.

We previously attempted to build a plug-in for Navigator 2.0 that presented the user with buttons and scroll bars for manipulating the displayed image. It worked just fine—until we scrolled through the browser window. The resulting screen paint was very ugly. Buttons would lose their position, and the scroll pane was never sure where to update itself on the screen.

The solution is to build the direct-manipulation elements from standard HTML elements and use JavaScript to communicate with your plug-in. Go back to the SDK to modify another sample project. This time it's the `CharFlipper` sample code.

Communication between a Web-page user-interface element and a plug-in requires three levels: the JavaScript User Interface component, Java *glue*, and the plug-in itself. This chain of events is illustrated in the figure "Using JavaScript to Operate a Plug-In" on page 63. Each level requires a method (i.e., a function) with the same name. In our example, it's Rotate. This method rotates the displayed image 90 degrees clockwise each time it's called.

We can start at the user-interface level by attaching a JavaScript statement to a simple button that says "Rotate." The JavaScript statement is as follows:

```
onclick="document.ImageViewer.
  Rotate();"
```

JavaScript cannot directly call the plug-in. It must use a simple Java class as its glue. For that purpose, we created a Java class, called `ImageViewer.class`, which is placed in the Netscape plug-ins folder. This class contains a method definition as follows:

```
public native void Rotate();
```

It's that simple. The JavaScript calls the method in the Java class, which is defined as native. Java knows to seek out a plug-in with the same name as this class and then call the proper C++ method.

Now we call the C++ plug-in ImageViewer. The Rotate method that Java calls is declared as follows:

```
void native_ImageViewer_Rotate
  ( JRIEnv* env, struct
     ImageViewer * self );
```

The naming convention can get a little long, but it's pretty clear. The `env` and `self` parameters are used to obtain access to the object instance. You need to do a standard invocation first, as shown in the second section of the table "Code Gallery."

The interplay of HTML, JavaScript, and custom plug-ins provides a powerful combination of cross-platform presentation and native compiled-code speed. Although Navigator is still a work in progress, version 3.0 provides a strong base upon which useful applications can be built. B

Andrew Taylor and Raymond GA Côté develop custom cross-platform applications at Appropriate Solutions, Inc. (Peterborough, NH). You can contact them at **aetaylor@AppropriateSolutions.com** *and* **rgacote@AppropriateSolutions.com**, *respectively. The Snowbound imaging library can be found at* **http://www.snowbnd.com**.

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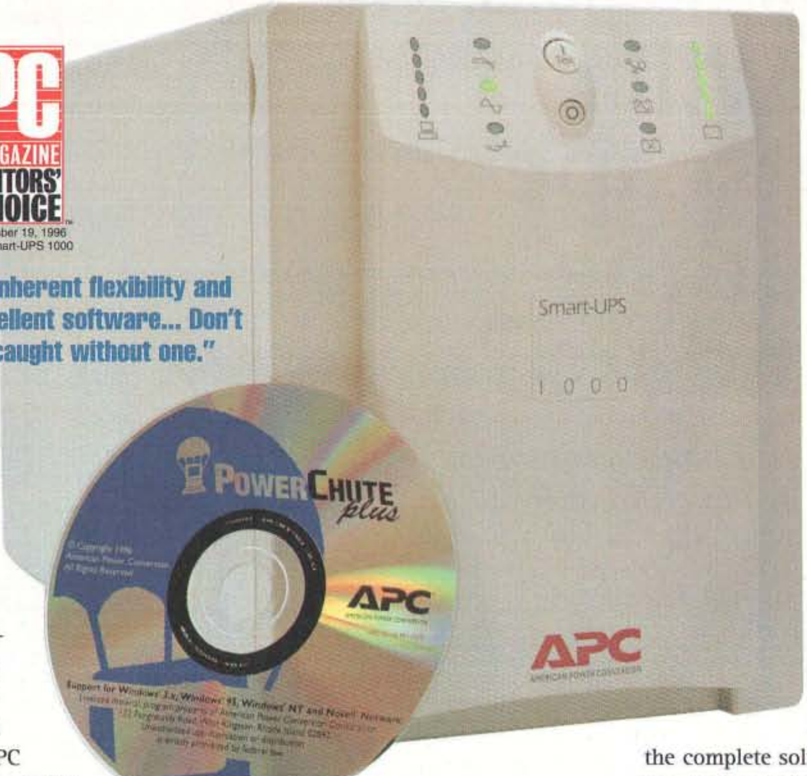

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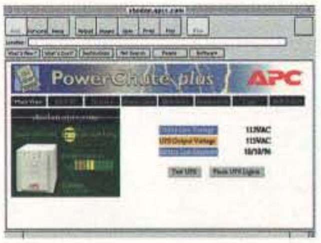

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Net Applications: Will Netscape Set the Standard?

Netscape again builds on Internet standards as it moves from browsers to Internet-enabled groupware.

By Jon Udell

In 1995, Netscape's Navigator changed the course of computing. It became the world's most popular application and transformed an obscure pastime—seeking information and running applications on the Internet—into a routine activity for tens of millions of people. But in 1996, Microsoft fought back. Internet Explorer matched Navigator's features (albeit only on late-model Windows platforms) and began to erode Netscape's browser hegemony. It's a take-no-prisoners modus operandi we've seen before from Redmond. "Everybody in the software industry just takes it for granted that Microsoft wants to put us out of business," says Marc Andreessen, Netscape's cofounder.

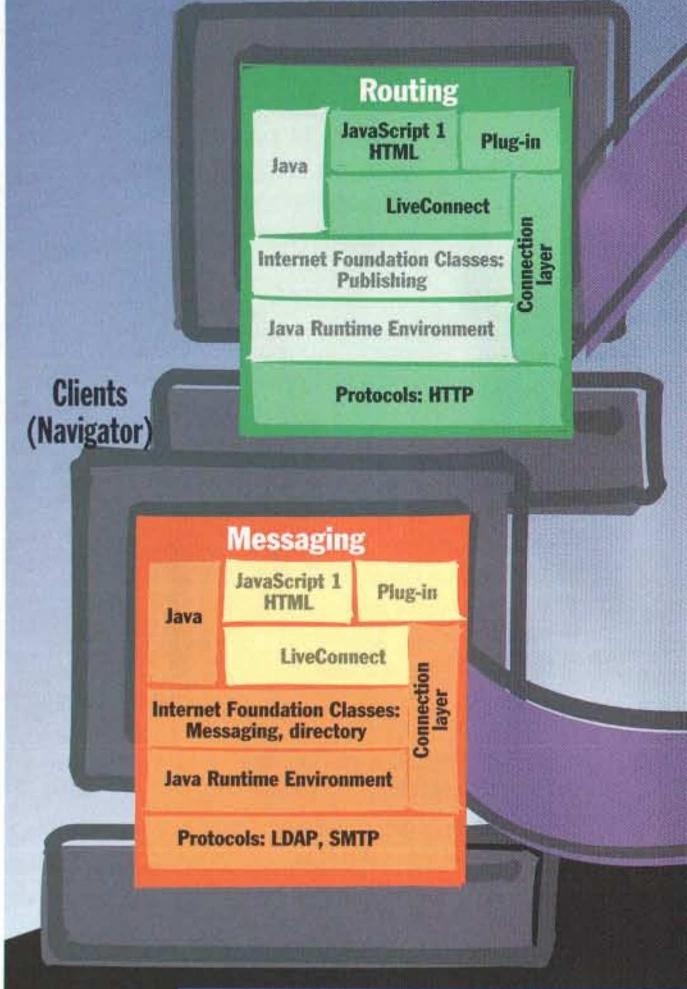
But the company isn't rolling over. This year, Netscape aims to prove that its real business is not browsers but Internet-enabled groupware. The good news is that this isn't merely a battle for dominance between Netscape and Microsoft; the spoils of this war—in the form of better communications and collaboration, more-intelligent clients, and programmable servers—will go to companies that use the Internet and intranets to underpin business processes.

Tomorrow's Internet

How might this competition change the Internet in the next year? In Netscape's view, we'll all routinely send graphics and active content in e-mail, share centralized schedules with coworkers, confer with customers via local newsgroups, and find resources in directories, among other changes (see "What to Expect from Next Year's Net" at right).

To put this laundry list of features in perspective, let's consider how one business I know well—BYTE magazine—could use them. Netscape's vision of global groupware became real

In this hypothetical work-flow application, purchase orders are routed and logged using a combination of Netscape plug-ins and Java components. Note that the same Internet Foundation Classes (IFC) run on both clients and servers. Underpinning the IFC are standard Internet protocols, such as Lightweight Directory Access Protocol (LDAP) and Simple Mail Transport Protocol (SMTP).

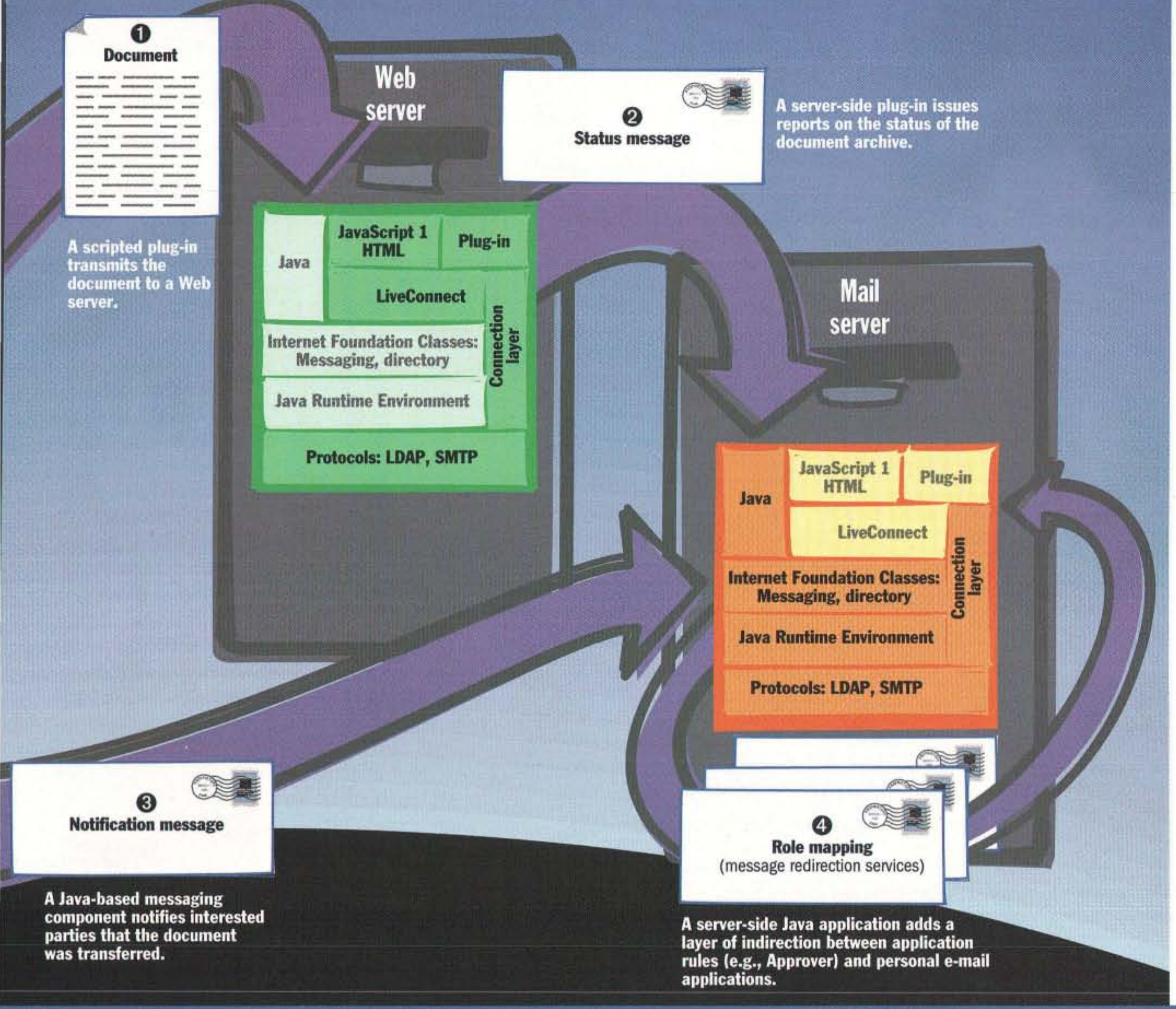


What to Expect from Next Year's Net

Rich content everywhere. Web pages sport text, graphics, and active content, but today's Internet e-mail messages and Usenet postings typically lack this richness. Communicator, the next-generation Netscape client suite, aims to make Hypertext Markup Language (HTML) the standard for all user-generated content.

Secure mail. Encrypted sessions between Web servers and browsers are commonplace today, but few e-mail messages travel over a secure channel. Communicator's mail client will be one of a number of applications that are compliant with Secure Mul-

A Netscape ONE Document Control Application



A scripted plug-in transmits the document to a Web server.

A server-side plug-in issues reports on the status of the document archive.

A Java-based messaging component notifies interested parties that the document was transferred.

A server-side Java application adds a layer of indirection between application rules (e.g., Approver) and personal e-mail applications.

tipurpose Internet Mail Extension (S/MIME) and make the public Net safe for private messaging.

Authenticated mail. Internet mail today is shockingly vulnerable to forged identities. Communicator's mail and news clients will use digital IDs (aka client certificates) to prove that we are who our message headers say we are. The mail and news servers in Netscape's forthcoming SuiteSpot 3.0 family will know how to check digital IDs.

Controlled discussion. Site-specific newsgroups enable focused discussions that leverage Network News Transfer Protocol (NNTP) servers and clients but that can enjoy a higher signal-to-noise ratio than often prevails on the regular Usenet. Effective control of users' access to NNTP conferences is a problem today. Netscape says its next-generation news server, Collabra Server 3.0, will enable controlled use of local newsgroups both within and across corporate boundaries.

Location independence. While you can access Web, news, and mail content from any Internet node, it's really a hassle to synchronize local data across multiple nodes—for example, your office machine, home machine, and road machine. Part of the answer is the Internet Message Access Protocol (IMAP), which Netscape's new mail client (Messenger) and server (Messaging Server 3.0) will support. These products, or interoperable equivalents from other vendors, will enable your complete mail environment to float from machine to machine. Netscape's newly announced Constellation, a universal Internet desktop, will further strengthen the mail client's location independence.

Directory lookup. Internet e-mail programs come with address books, but today you typically can't look up names in a directory. Communicator will enable lookups using the Lightweight Directory Access Protocol (LDAP), and the SuiteSpot mail, news, and Web servers will also use LDAP to authenticate users against a Netscape (or other LDAP-compliant) directory server.

Open scheduling. You probably share your calendar with colleagues on the LAN, but you almost certainly don't share it over the Internet with business partners. Communicator's calendar component will do just that, at first only with Netscape's Calendar Server, later (when the Internet Calendar Access Protocol has gelled) with any ICAP server.

Constellation: The Ne

"Where do you want to go today?" asks Microsoft. "Not where you're taking us," says Netscape.

Microsoft and Netscape both want to change how users interact with their computers in a wired world. But each company wants to steer those changes in a different direction. Whoever prevails will probably determine the face of computing for the next decade.

Both companies are preparing for an age of ubiquitous networking in which users enjoy fast access to immense resources on LANs, WANs, and the Internet. They share some common goals: Give users a seamless view of local and remote resources; take advantage of the latest Web technologies that automatically deliver filtered information to masses of users; and build a cross-platform user interface based on Hypertext Markup Language (HTML) that unifies the experience of network-centric computing.

Microsoft's Active Platform–manifested on a PC as Active Desktop–leverages the market dominance of Windows by blending the user interfaces of Windows and the Web. Users can browse their systems as if the local disks were a Web site or explore Web sites as if they were local disks. Internet Explorer 3.0 already allows this to some extent, but much more is coming in Explorer 4.0 and Windows 97.

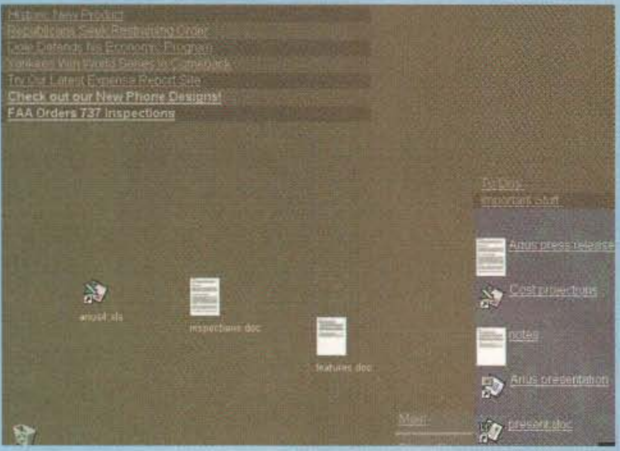
Because Active Desktop relies on dynamic HTML, JavaScript, and VBScript, it will eventually run on other platforms, including Macintoshes and Unix systems. However, Active Desktop will always run better on Windows, Microsoft says, because it is more tightly integrated with Windows, and it can call upon the services of Microsoft's DirectX multimedia APIs and a wider variety of ActiveX controls.

An Open Answer

Netscape's Constellation takes a less Windows-centric approach and puts more emphasis on location-independent computing, regardless of the platform. No matter what kind of system you're using or where you are, Constellation presents a universal desktop called the Homeport. Although the Homeport can appear in a browser window, Netscape usually demonstrates it as a full-screen layer that buries the native OS–certainly one reason Microsoft is not embracing Constellation.

Constellation will work on about 18 different OSes because it's created entirely with HTML, JavaScript, and Java. Netscape envisions the Homeport as the new base for launching local or remote applications and for accessing the network. It's location-independent because Constellation can save the Homeport's state (including all data files created or modified during a session) on a server. The server (running Netscape's SuiteSpot 3.0) can be anywhere on an intranet or the Internet. When you log on, the server restores your Homeport and lets you pick up working where you left off. When you're done, Constellation lets you save copies of your files on the local machine, encrypt the copies, or securely erase all local traces of your session.

Add-ons such as Norton Desktop for Windows and At Ease for the Mac have offered replacement desktops for years. But they don't offer location independence across multiple platforms: You can't start a session on a Windows PC at the office and finish it at home on a Mac. Constellation is designed to eliminate the file-synchronization and compatibility problems that bedevil mobile users today.



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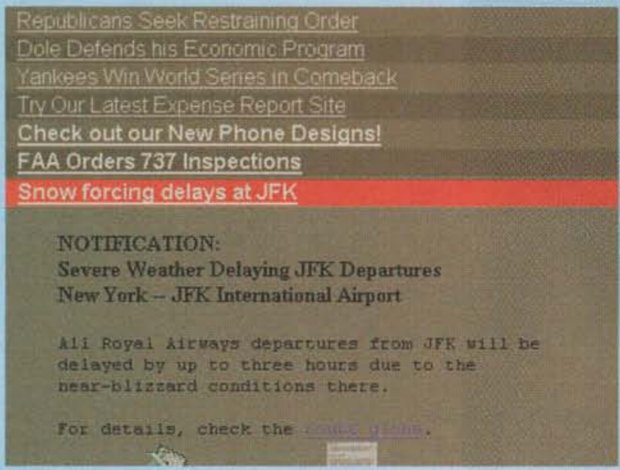
Netscape's Constellation displays a universal desktop environment called the Homeport.



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For details, check the [illegible].
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Constellation's "smart-pull" capabilities bring instant notification of requested information directly to the desktop.

Network Centricity

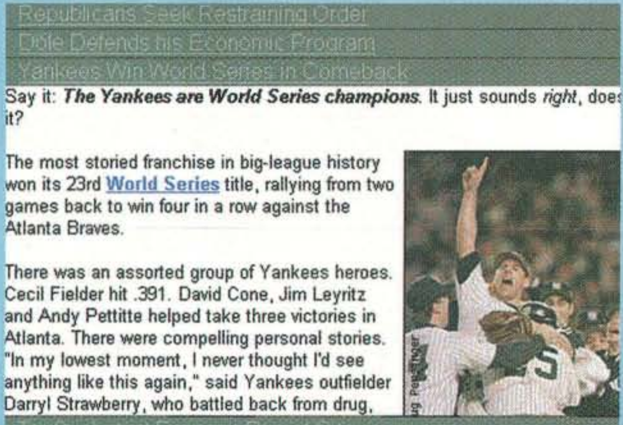
Of course, to really make this work, the applications should be as cross-platform and as network-centric as Constellation. Users can launch native applications such as Microsoft Office from the Homeport, but

---

for me last year when I launched The BYTE Site. It serves three constituencies: BYTE staff, BYTE readers, and hardware and software vendors. Members of each group are scattered around the world, and they're interconnected by Web, e-mail, and conferencing applications. For example, when a reader comments on an article in our online archive, the site relays the message to an appropriate group of editors. When a vendor submits an electronic press release, the document moves to a private archive visible only to the magazine staff or to a public one visible to the world.

These are examples of the kinds of Internet applications that every business can use to work more effectively with its customers and suppliers. You can build them today, but there are limitations. I use e-mail as an application transport, but I would use it more extensively if I could establish secure channels. We run NNTP (Network News Transfer Protocol, the protocol that links Usenet groups on the Internet) conferences publicly, but not yet privately because access controls are too primitive. We'd like to target applica-

work-Centric Desktop



Republicans Seek Restraining Order

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Yankees Win World Series in Comeback

Say it: ***The Yankees are World Series champions.*** It just sounds *right*, does it?

The most storied franchise in big-league history won its 23rd World Series title, rallying from two games back to win four in a row against the Atlanta Braves.

There was an assorted group of Yankees heroes. Cecil Fielder hit .391. David Cone, Jim Leyritz and Andy Pettitte helped take three victories in Atlanta. There were compelling personal stories. "In my lowest moment, I never thought I'd see anything like this again," said Yankees outfielder Darryl Strawberry, who battled back from drug,

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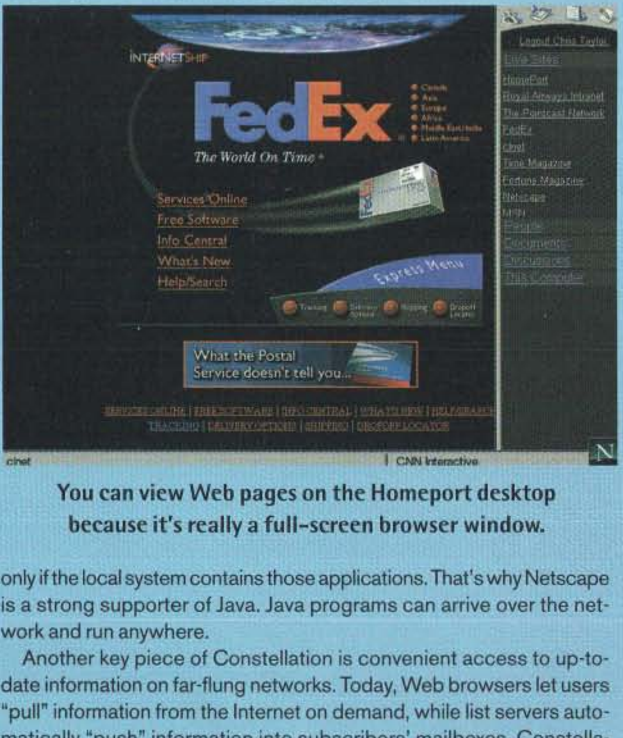
"Infoblocks" and Homeport control panels stay hidden until needed, then slide out from various sides of the screen.



You can view Web pages on the Homeport desktop because it's really a full-screen browser window.

only if the local system contains those applications. That's why Netscape is a strong supporter of Java. Java programs can arrive over the network and run anywhere.

Another key piece of Constellation is convenient access to up-to-date information on far-flung networks. Today, Web browsers let users "pull" information from the Internet on demand, while list servers automatically "push" information into subscribers' mailboxes. Constellation takes advantage of the latest Web technology to supplement those methods with something called "smart pull": the timely delivery of selected information directly to the user's desktop. Users get only the information they asked for, without tedious browsing. And Constellation can notify users as soon as the information is available. These infostreams may contain anything from a stock quote or a sports score to a company memo.

Constellation can receive infostreams through Hypertext Transfer Protocol (HTTP), Simple Mail Transfer Protocol (SMTP), Marimba Castanet, and the PointCast Network. HTTP and SMTP are the more conventional methods. They allow senders to encrypt the data within Secure Sockets Layer (SSL) or Secure Multipurpose Internet Mail Extension (S/MIME). A special tag tells Constellation to route the infostream directly to the Homeport, where JavaScript displays it as an HTML pagelet or as an "infoblock" that pops up from the bottom of the screen.

Castanet is designed to broadcast selected information to large numbers of people by using Marimba's Transmitter and Repeater servers. Transmitter is the server software that sends information to users who have requested the information by "tuning in" with Marimba's client software, known as Tuner. (Constellation includes a custom version of Tuner.) Repeaters are mirrored Transmitters that permit large-scale broadcasts without bogging down the Web.

PointCast is a more established Webcasting network that also delivers filtered information. PointCast can host the content of smaller providers who don't have their own servers, Netscape says.

Active Desktop will let users smart-pull information from various sources, too; it remains to be seen which environment works better. But aside from implementation details, the main differences between Active Desktop and Constellation originate from Microsoft's and Netscape's different views of the future.

Will Windows Dominate?

Microsoft sees Windows as the dominant platform on all types of devices for years to come, so Windows compatibility is paramount. Other platforms need to interoperate with Windows and with Windows technologies such as ActiveX, but Windows running on a PC will continue to be the most common computing experience, and Microsoft will fight to preserve that experience.

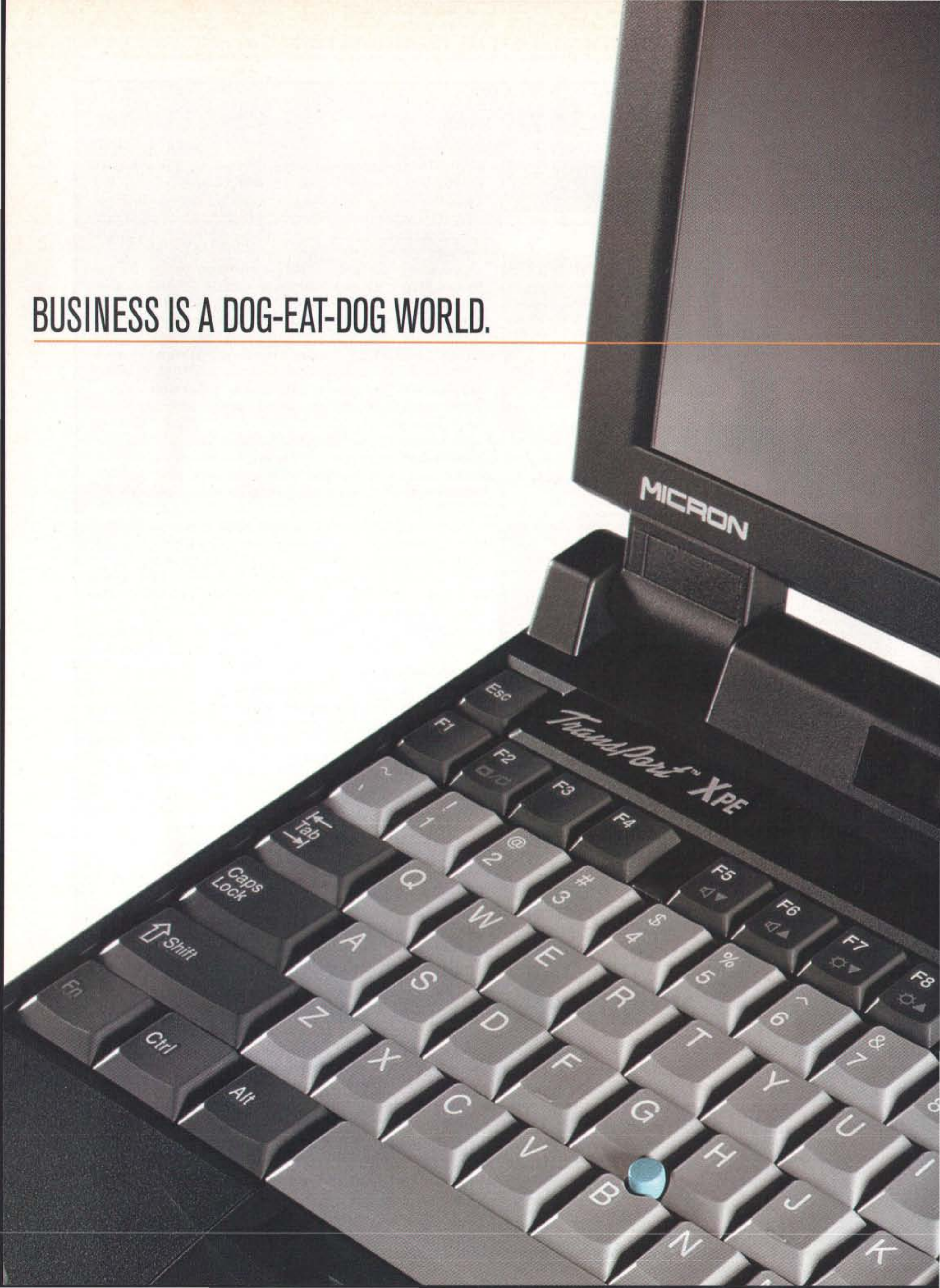
In contrast, Netscape sees more platform fragmentation. Users will access networks from Windows PCs, of course, but also from Macs, Unix systems, network computers, home videogame consoles, Web appliances, and mobile devices of every stripe. They won't all run Windows. Netscape also expects more users to borrow time on computers they don't own; for example, business travelers might answer e-mail on network computers in airports and hotels.

The growing ability to tap into global data networks from almost anywhere on almost any kind of device is the driving force behind Constellation. It explains why Netscape views the network, rather than any particular breed of client, as the center of the new universe.

Tom R. Halfhill *(thalfhill@bix.com) is a BYTE senior editor based in the San Mateo, California, bureau.*

tions to specific groups of vendors or readers, and we would if common directory and certificate services enabled us to administer these groups. We'd like to standardize on our own site's Internet mail server, and we might if our staff could easily synchronize the various machines from which it accesses that server. And I'd kill for Internet-enabled scheduling; much of the research for this story involved coordinating interview times with industry people in many time zones.

The next set of Internet standards—including Lightweight Directory Access Protocol (LDAP), Secure Multipurpose Internet Mail Extension (S/MIME), Internet Message Access Protocol (IMAP), Java, and Internet Interoperable ORB Protocol (IIOP)—will take us into this era of global groupware. All groupware platforms will have to embrace Internet standards in order to survive. For Lotus's Notes, Microsoft's Exchange, and Novell's GroupWise, the challenge is to take existing systems that in many respects already do what Netscape's next-generation products will do and reengineer them around cur-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rent and emerging Internet standards.

Netscape's astonishing two-year sprint has shown its extraordinary gift for identifying and nurturing the standards on which a business-capable Internet must be built. Hypertext Transfer Protocol (HTTP), Hypertext Markup Language (HTML), Simple Mail Transport Protocol (SMTP), and a few others powered the initial Web frenzy. This time, however, things will be different. Netscape's competitors are lining up behind the same next-generation standards, and the company now has its own installed base to move forward. What's more, the full-service Internet that Netscape envisions requires a lot more infrastructure and planning than was necessary just to fire up your corporate Web site. To those challenges, add one more: Microsoft has its own ideas about the future of the Internet, and any one of them could derail Netscape's plans.

By the time you read this, Netscape plans to have released a suite of client and server products that will solidify its vision of Internet-enabled groupware. What kinds of communication and collaboration will these products enable? How can applications developers leverage the new features on clients? On servers? I can't say for sure, because the code wasn't downloadable at press time, but here's what I've learned so far.

Six Ways Microsoft Could Foil Netscape

1. **NT momentum.** Corporations are flocking to Windows NT. And while Netscape does sell a lot of Internet servers into NT environments, Microsoft's Internet servers integrate far more tightly with NT.

2. **Mature component framework.** Microsoft has been refining its component model for years. The forthcoming Visual Basic 5 makes construction of ActiveX components a trivial task. It's true that Netscape's preferred alternative, the Common Object Request Broker Architecture (CORBA), appeals increasingly to corporate developers. But CORBA is an object model (like Microsoft's Common Object Model, or COM), not a component framework like ActiveX. What's the open-systems counterpart to ActiveX? Probably Java Beans, but the ink has barely dried on that specification.

3. **Desktop monopoly.** Windows' ownership of the desktop creates endless opportunities for Microsoft to marginalize Netscape's client software. When Windows subsumes Internet Explorer, Navigator's days of browser dominance may be numbered. More subtly, Microsoft's ActiveX-enabled Java virtual machine will bias client-to-server connectivity away from Netscape's preferred method, the Internet Interoperable ORB Protocol (IIOP), and toward Microsoft's Distributed Common Object Model (DCOM).

4. **Transaction Server.** One thing is missing from the list of server programmability features in Netscape's Enterprise Server 3.0: TP monitor support. That's slated for Enterprise Server 4.0, but Microsoft will get there first. Using beta versions of Internet Information Server 3.0 and Transaction Server, developers are already learning how to create Web pages that run under transactional control with automatic pooling of threads and database connections.

5. **Language neutrality.** Netscape strongly favors a combination of Java and JavaScript for both client and server development. Microsoft's emphasis is on the ActiveX framework–write components in C++, Java, or even COBOL, script them with VBScript, JavaScript, Perl, or Python. This strategy troubles Netscape cofounder Marc Andreessen, who wonders, "Do we really want to encourage language proliferation?" Maybe not, but it's a reality.

6. **Open standards.** Say again? Netscape should fear Microsoft's support for open standards? It's strange but sometimes true. Microsoft beat Netscape to the draw with an implementation of Cascading Style Sheets (CSS). Netscape will go one better with JavaScript Style Sheets (JSS), a JavaScript-programmable superset of CSS, but not until Navigator 4.0. Meanwhile, Microsoft can gleefully proclaim itself a better Net citizen, in this regard, than Netscape. The rules are changing fast, and so is Microsoft.

Communication and Collaboration

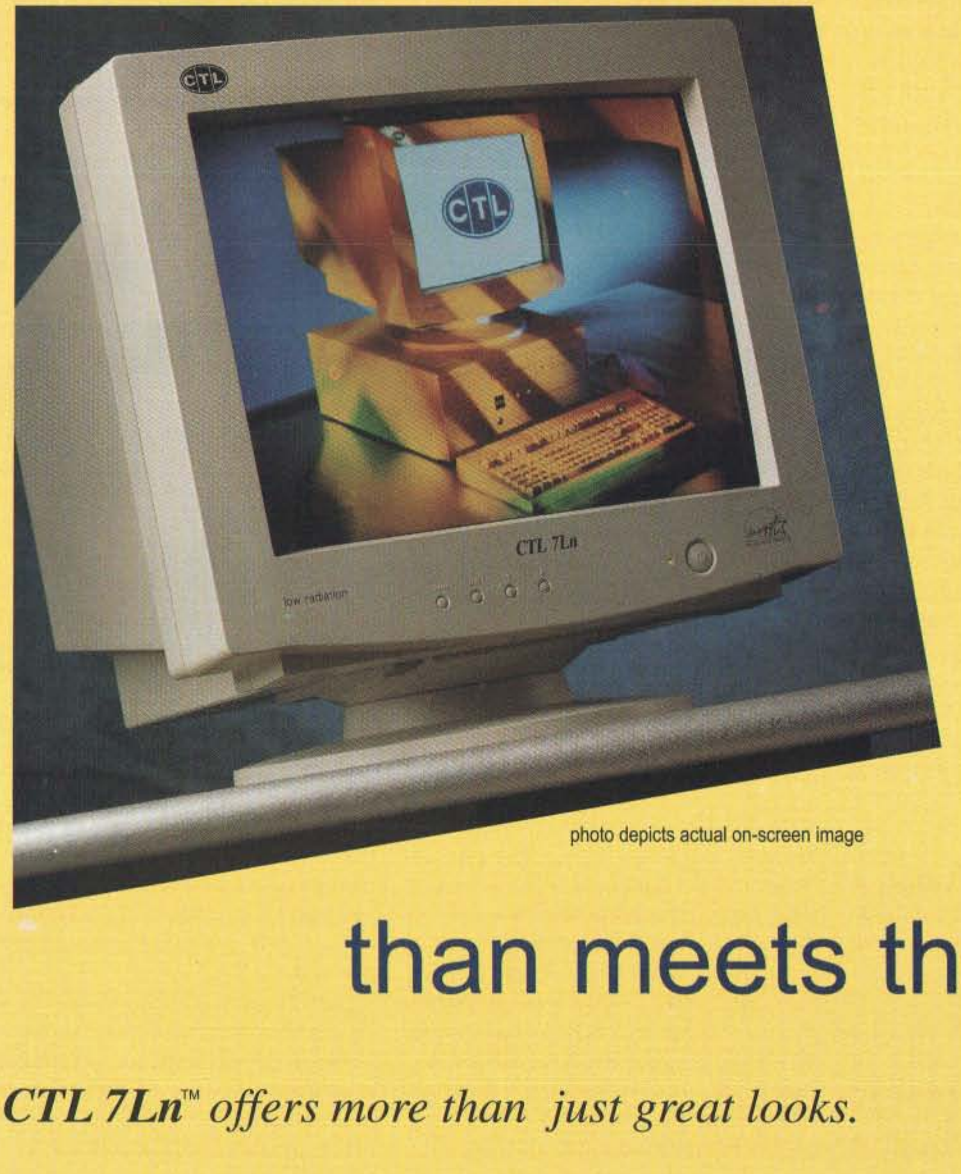
Since version 2, Navigator has actually been a suite of applications, consisting of a mailer and a newsreader as well as a browser. That suite is already a more functional groupware platform than is commonly recognized. For example, because the mailer and the newsreader automatically activate URLs, they support basic hypertext authoring. If you spell the URL correctly, you can mail me a link to the document rather than the document itself, and you can include the link in a newsgroup posting. Because the browser understands news:// URLs, ad hoc discussions created in this way can merge in Web space with formally published documents. Because these discussions can use a channel protected by Secure Sockets Layer (SSL), collaboration can be private. What's more, since version 2 the mailer (though not the newsreader) can render quite a bit of HTML. That's significant not only because I can mail you in-line text and graphics, but because I can send you an HTML form wired to a script—in other words, an application.

What can Netscape improve? Plenty. It starts with Composer, a simple HTML editor you can use to write e-mail messages and newsgroup postings. There are fancier HTML editors, to be sure, and even these only do what word processors have been doing for years. But it's the humble message-composition tool in mailers and newsreaders that pumps billions of words onto the Internet every day. Composer will invite users to abandon decades-old ASCII formatting conventions and embrace styled text, colors, bulleted lists, more readable hyperlinks, and even active content. Other Internet clients will follow suit, and with any luck HTML will by year-end be well on its way toward displacing plain ASCII as the lowest common denominator for all forms of Internet content.

One of the highlights in Communicator (see "Internet Communicator par Excellence" on page 76) is a directory lookup that uses the new address book (shared by the mail, news, and calendar clients) to fetch names from two sources. One is a private corporate directory running on Netscape's directory server. The other is Four11, a public Web-based service that supports e-mail-address lookups. To an Internet newcomer, this would seem completely unremarkable. Didn't the Internet always work this way? Well no, actually, it did not, and it still does not, but it will soon thanks in large part to Netscape's aggressive sponsorship of the Lightweight Directory Access Protocol (LDAP) standard.

A few years back, AT&T and Novell proposed an alternative, business-grade Internet built around the NetWare Directory Service (NDS). It didn't fly for lots of reasons,

there **IS** more to this...



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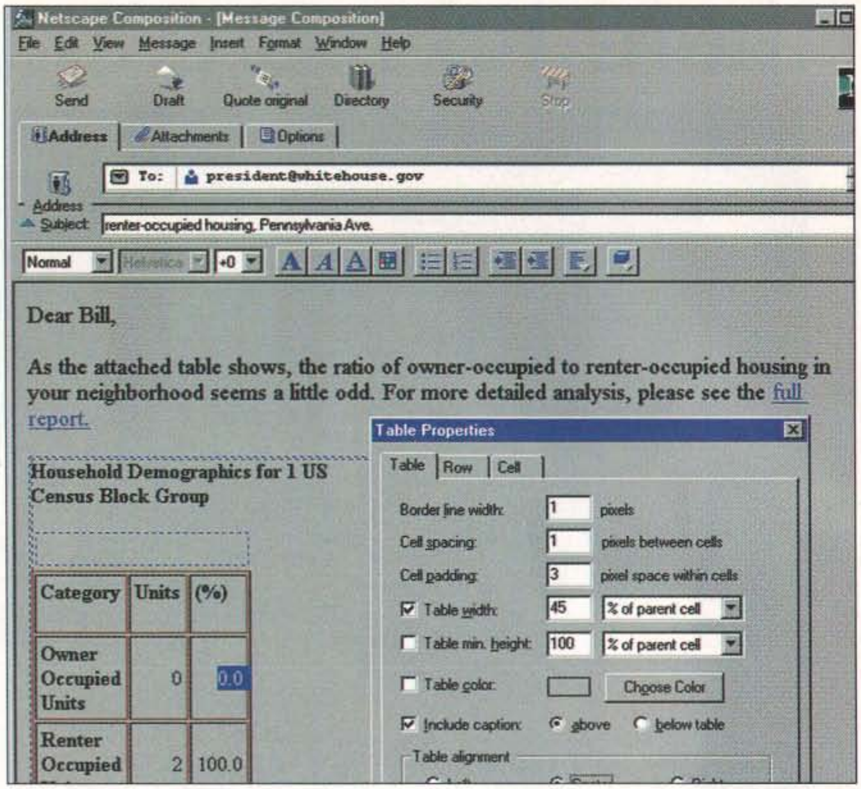

To: president@whitehouse.gov

Subject: renter-occupied housing, Pennsylvania Ave.

Dear Bill,

As the attached table shows, the ratio of owner-occupied to renter-occupied housing in your neighborhood seems a little odd. For more detailed analysis, please see the full report.

Household Demographics for 1 US Census Block Group

Category	Units	(%)
Owner Occupied Units	0	0.0
Renter Occupied	2	100.0

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Table alignment

Composer (embedded here in the Communicator mail client) aims to make HTML the lowest common denominator for Internet text.

including the requirement for a global, singly rooted NDS tree. This top-down model was antithetical to the organic ferment that powers the Internet's growth. LDAP, by contrast, encourages a bottom-up approach. "We'll have our subsidiary companies manage their own independent directories," says Laird Popkin, director of technology and architecture for The News Corporation's Internet services division, "then use LDAP replication to mirror everything up to an umbrella corporate directory." Companies can build LDAP servers from scratch or wrap an LDAP interface around existing directories. Four11 president Mike Santullo says it took less than a week to LDAP-enable his service.

With Communicator's S/MIME-capable mailer, I can send you a message that's encrypted and digitally signed. Encryption means that no one but you can read it; I've scrambled the message using your public key, and only your private key can unscramble it. Digital signature ensures that no one but me could have written the message. I've attached a digest of the message that's been scrambled with my private key. Your system can unscramble the digest using my public key, then generate a fresh message digest; if the two digests match, the signature checks. There's nothing new here—Lotus Notes users, for example, have been able to do these things for years. What is new is the notion of inviting tens of millions of Internet users to routinely apply public-key cryptographic methods. This scenario raises two enormous challenges for the future.

First, the infrastructure challenge. Who will operate the directories in which we look up each other's certificates and keys? Who will manage the certificate authorities that bind public keys to identities? Netscape has recently shipped directory and certificate servers that handle these chores at the corporate level. VeriSign runs an Internet-wide certification service. Four11 plans to host directories for companies that wish to outsource directory service; it's possible because Netscape's LDAP rides on SSL, which ensures traveling the Internet securely. Companies that commit to a public-key infrastructure will have to figure out what these solutions entail, and in what combinations to deploy them.

Second, the useability challenge. Among the remarkable achievements of Navigator was the way in which it made one form of public-key cryptography—an SSL-secured session between a browser and a Web server—absolutely trivial to use. You just click on an https:// (the *s* stands for secure HTTP) link and bingo: The iconic key heels, a blue border appears, and you can type your credit-card number into a secure form. Will it be possible to achieve the same level of simplicity in operations such as S/MIME encryption and signing, which require people to have and use private keys? "Yes, with smartcards," says Andreessen. Before that's a widespread option, though, Communicator and other secure Internet clients will have to teach us all how to use cryptographic keys and certificates. A security advisor embedded in Communicator is one of the ways Netscape is tackling this problem.

Evolution or Revolution?

Making secure collaboration pervasive requires a quantum leap in how we use the Internet. There are compelling reasons to make that leap. Once you've distributed client certificates to everyone on your Netscape intranet, for example, they'll be able to log on once to access permitted resources on all SuiteSpot 3.0 mail, news, Web, and directory servers. Secure e-mail can flow within and across corporate boundaries; that's useful not only for interpersonal communication but also for e-mail-based commercial transactions. If you host public discussions, you can protect yourself against forged and libelous postings.

The benefits are substantial, but so is the effort and cost to migrate from a username/password model to a cryptographic certificate system. "Netscape doesn't have a huge legacy to support," says Chris Allen, president of Consensus, an SSL toolkit provider, "so they'd like to move to a complete certificate world very quickly." Microsoft, he points out, favors a more evolutionary approach. Internet Explorer can, for example, securely authenticate to Internet Information Server using the Windows NT challenge/response protocol to transmit the client's password securely. "Customer requirements and convenience make passwords useful," adds Consensus' lead developer Tim Dierks. "Let's not be cryptosnobs. CompuServe has jillions of users with passwords. They see a huge cost in deploying certs."

NNTP-based conferences running locally at sites such as netscape.com and microsoft.com enable thousands of devel-

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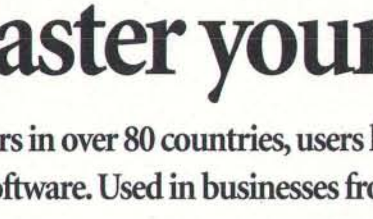

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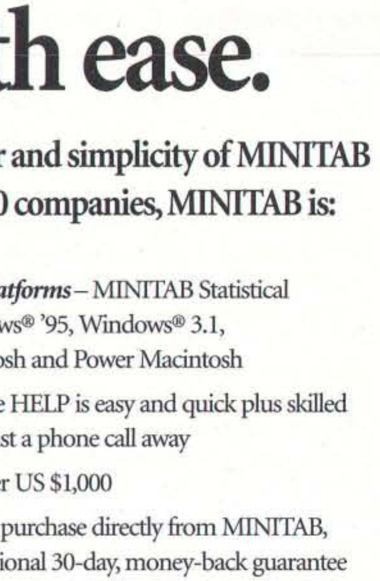

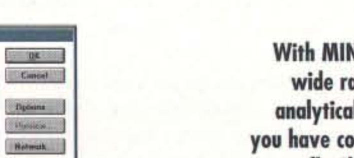

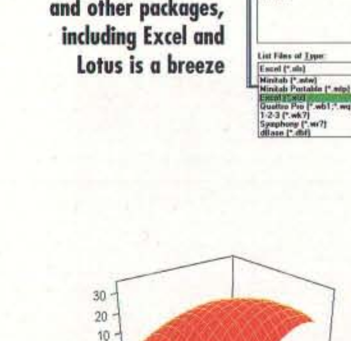

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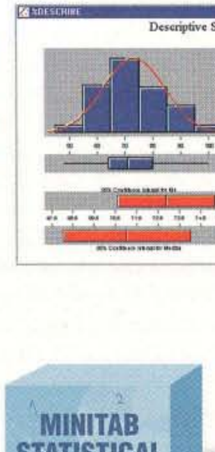

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opers to pool knowledge and exchange views. As valuable as these conferences are, though, they leave a lot to be desired. Users can't search them, categorize them, or reorganize their views of them. The developers Netscape got when it acquired Collabra have now addressed these limitations. Netscape's forthcoming Collabra client and server are not simply Collabra Share with a Netscape label. They're a long-overdue and much-needed next generation of NNTP technology. The client manipulates views of the message base in ways that will remind you (not accidentally) of Lotus Notes. It can also now work off-line, as Forte's, Microsoft's, and others' newsreaders have done for some time.

Collabra Server comes with a full-text indexer and a sophisticated access control mechanism. To support the new features, Netscape has proposed extensions to NNTP and submitted these to the Internet Engineering Task Force for approval. It's nice to see this venerable protocol moving forward. NNTP conferences are an increasingly popular mode of collaboration. When operated locally—that is, apart from the regular Usenet—these discussions create documents that can have long-term value to your business. Netscape's new Collabra tools will help you organize and manage those documents.

Programmable Client

First-generation Web technology was compelling to groupware developers because you could deploy applications to users anywhere in the world on any kind of computer. Universal access was possible thanks to a portable client that could render HTML pages and a portable server that could pump out canned pages and dynamically generate new ones. The trend now is to locate more intelligence on the client, in the form of plug-ins and Java or ActiveX components. But Netscape understands that there's still more mileage to be gotten out of basic HTML, or HTML mixed with JavaScript. To that end, Communicator's HTML-aware components will support several new HTML features:

Absolute x-y positioning. Purists argue that HTML's job is only to describe content, not to specify details of its presentation. But as the definition of content broadens to include all kinds of GUI widgetry, application developers legitimately require a grid-like canvas. Microsoft solves this with its HTML Layout Control,

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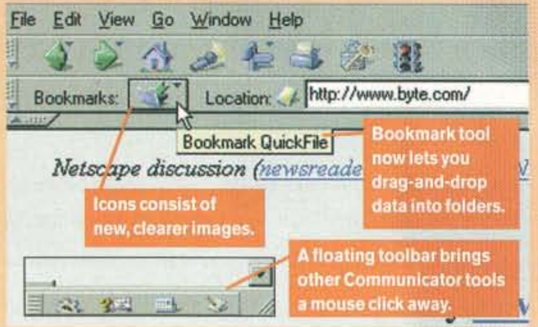
BYTE EVAL Communications Tools

More than just a browser, Netscape's Communicator makes the Internet easier than ever to use. By Pete Loshin

Internet Communicator par Excellence

Netscape's Communicator, with its full set of Internet and intranet communications tools, is a sort of Swiss Army knife for Web surfers. The $49 version is a suite that includes version 4.0 of the Navigator browser, the Messenger e-mail utility, Composer (a Hypertext Markup Language [HTML] editor), Netscape Collabra (groupware), and Conference (with both voice and virtual-whiteboard conferencing). For $79, Communicator Pro adds even more: Netscape's new Constellation desktop interface; Calendar, for workgroup scheduling; Autoadmin, for centralized Communicator configuration; and a Java-based 3270 emulation for mainframe access.

The latest version of Navigator adds HTML support for layering (which allows easy animations), style sheets for easier page design, and absolute positioning. The new </Object> tag simplifies insertion of Java applets, and AutoInstall uses digital signatures for secure downloading of plug-ins. But the big news for me was better bookmarking. To add a bookmark, you just drag the Location icon onto the Bookmarks icon and drop the URL into the main bookmark list or into any subfolder.



http://www.byte.com/

Bookmark tool now lets you drag-and-drop data into folders.

Icons consist of new, clearer images.

A floating toolbar brings other Communicator tools a mouse click away.

Communicator's new look includes smarter icons, toolbars you control, and easier bookmarking.

With Composer's one-button Web publishing you can preconfigure your Web-site log-on so that you can upload the current document, graphics and all, with a single click. Building links, adding graphics, and performing other important HTML tasks are all part of the GUI, as are automated table building and drag-and-drop insertion of Java applets and images.

Communicator stores mail messages and news items in their own folders in the Integrated Message Center. Enriched HTML is Composer's default for mail and news reading and writing, although you can switch to plain ASCII with a click. The Collabra groupware module supports secure discussion groups with SSL 3.0, and the Messenger e-mail module supports the Internet Mail Access Protocol (IMAP) for more flexible mail.

Using a simple fill-in form, you can have Messenger sort incoming mail based on almost any attribute. It can also search Lightweight Directory Access Protocol (LDAP) directories for Internet e-mail addresses. However, Collabra's most impressive new features, such as server-side searches of newsgroups, are currently available only in conjunction with a Collabra server.

Netscape Communicator $49
Communicator Pro, $79 (runs with Windows 95, NT, or 3.x; Mac OS 7.1 or higher; and assorted Unix flavors, including Linux)

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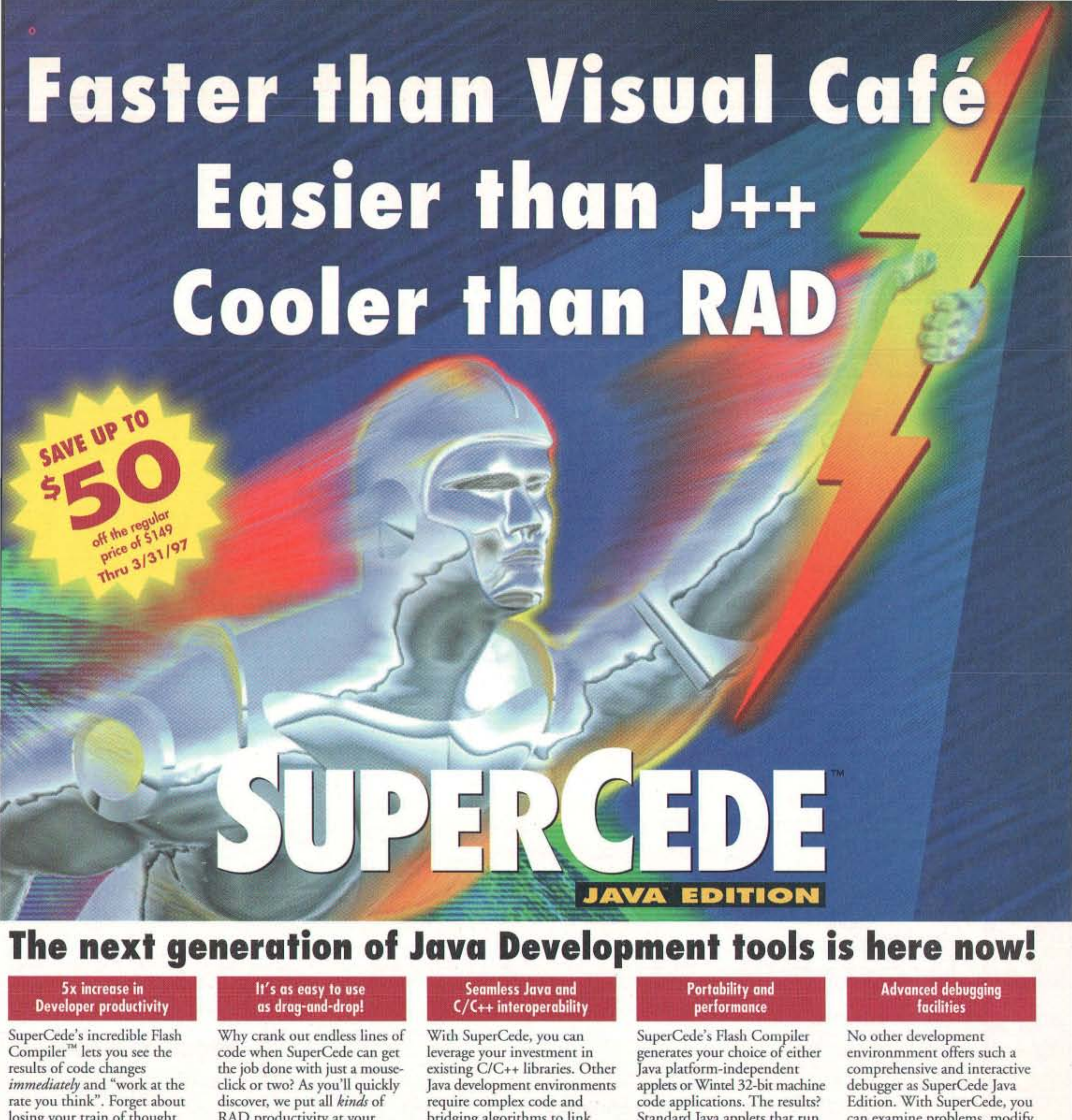
Voice output in Communicator's conferencing module was unreliable, with the sound quality alternating between excellent and poor. On the plus side, Conference includes an electronic whiteboard that should prove useful even over slower links. You can annotate the whiteboard screen using either the mouse or keyboard. A set of graphical tools go beyond the expected color pen and eraser to let you create straight lines and geometric shapes or drop an emphasis arrow anywhere on the board. You can save the whiteboard contents for future reference, and you can drop in graphics files or sections of your desktop to share over the whiteboard. A promised collaborative surfing feature was not implemented in the beta I used.

RATINGS					
TECHNOLOGY	★	★	★	★	★
IMPLEMENTATION	★	★	★	★	★

Communicator escalates the browser war. Its simplicity and integration of Internet/intranet tools will make it hard to beat in 1997.

Pete Loshin *is a BYTE technical editor. You can reach him at ploshin@bix.com.*

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor



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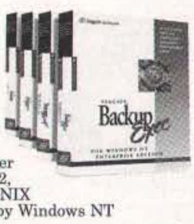

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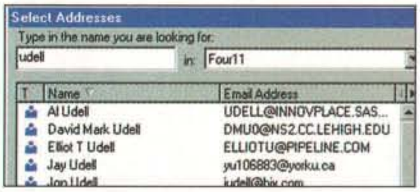
but of course only in the ActiveX environment. Netscape is promoting a general-purpose HTML solution. Because these two methods are significantly at odds, the layout issue represents a fairly serious threat to the universality of Web pages.

Layers. Netscape is adding a third dimension to the Web page. This means an HTML document can be a stack of layers that scripts can selectively activate. You can use this feature to create tabbed dialog boxes, or even simple animations, using nothing more than HTML and JavaScript. Why can't Java handle these chores? It can, but when a pure HTML/JavaScript solution will suffice, developers will find it easier to create and deploy, and users will find it quicker to load and run.

JavaScript Style Sheets (JSS). JSS marries HTML style sheets with JavaScript's ability to sense and react to things like the width of the browser's window. Styles can therefore adapt intelligently to the ambient properties of the viewer.

New Plug-Ins

Netscape plug-ins began as a way to use native code to render special data, such as PDF files or Shockwave animations, within the browser. In theory, native plug-ins won't be needed much longer because Java components will meet the same need and do so portably. In practice, that day is far off, and during this transitional era, plug-ins will continue to play an important role. To simplify their use, Netscape will unify the binary formats and the download mechanisms of plug-ins and Java components. And the company continues to emphasize LiveConnect, a kind of software bus that enables plug-ins, Java, and JavaScript to interact within the browser. With this technology, a plug-in can be more than a canned object that renders foreign data. It can become a first-class scriptable component around which you can build whole families of applications.



Type in the name you are looking for: udell in: Four11

T	Name	Email Address
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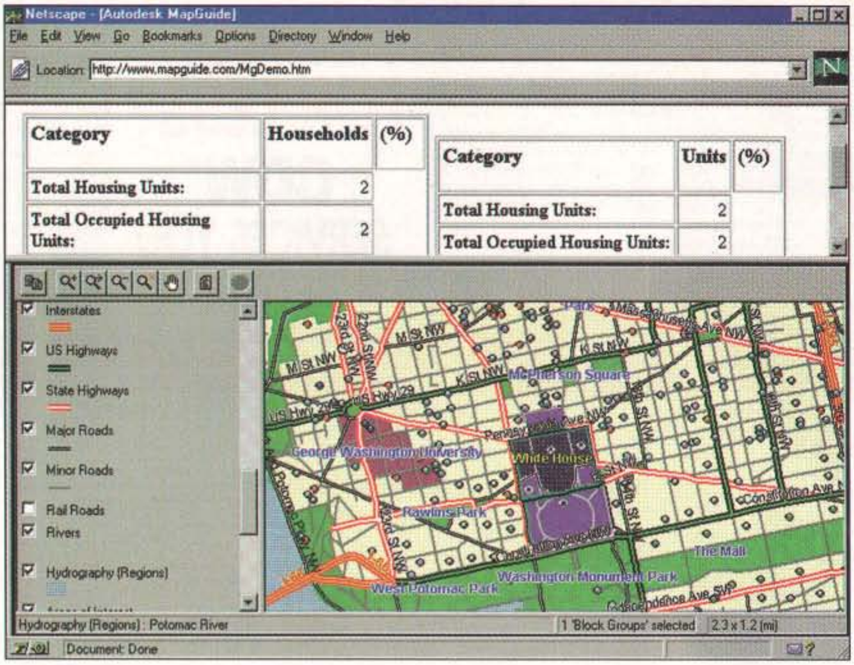
	Jon Udell	judell@bix.com

Netscape Communicator's address book is LDAP-enabled.

Autodesk's MapGuide demonstrates what you can do with a powerful plug-in that exposes methods and properties to Java and JavaScript by way of LiveConnect. In its vanilla form, MapGuide negotiates with a back-end geographic information system (GIS) to fetch map views of GIS data; the categories of information presented adjust dynamically according to the scale of the map. Under JavaScript control, MapGuide can create, for example, a distributed authoring system that a phone company might use to build an attributed map of its network. "It's a truly Net-centric system," says Rod Munro, Internet technology manager for Autodesk's GIS market group. Why isn't MapGuide written in Java? "We're too graphics-intensive," says Munro. That means the plug-in has to be ported to multiple platforms. Netscape's plug-in SDK isn't a write-once, compile-everywhere solution, and it doesn't isolate the plug-in developer from OS-specific APIs. But Autodesk is prepared to do the programming needed to give users maximum power and capability, as are many developers who today support multiple platforms.



Location: http://www.mapguide.com/MgDemo.htm

Category	Households	(%)
Total Housing Units:	2	
Total Occupied Housing Units:	2	

Category	Units	(%)
Total Housing Units:	2	
Total Occupied Housing Units:	2	

Hydrography (Regions) : Potomac River

1 'Block Groups' selected

2.3 x 1.2 (mi)

Document: Done

Autodesk's MapGuide, a JavaScript-enabled plug-in, can support an entire family of Web-aware GIS applications.

It would be handy if you could automatically convert your own custom C++ applications into Netscape plug-ins. Stingray Software's Objective Plug-in does just that for applications built using the Microsoft Foundation Classes (MFC). "Corporate developers are thinking Java long-term," says Scot Wingo, Stingray's cofounder. "But short-term, they've got a lot of MFC code that they need to Web-enable." Version 1 of Object Plug-in won't handle Java-to-plug-in communication, but Wingo says users are requesting LiveConnect support, and he hopes to add it in a future release.

Java Wrappers

Internet-enabled groupware applications will tend to do similar kinds of things: look up users in directories, send messages, store documents on Web servers. Netscape is encapsulating the protocols and services used to accomplish these tasks in a set of Java libraries called the Internet Foundation Classes (IFC). The first available IFC concerns itself, atypically, with GUI programming. It's a wrapper around JavaSoft's Abstract Windowing Toolkit. But Netscape also plans to bundle with Communicator a set of additional classes that will connect client-side Java programs to back-end security, messaging, discussion, directory, and publishing services.

It's a powerful idea. Suppose you're writing a work-flow application, in Java, that approves and routes purchase orders. With the security and messaging IFC in place, you could use secure e-mail as the application's transport layer. And you could deploy the application anywhere—even on a network computer. Note that

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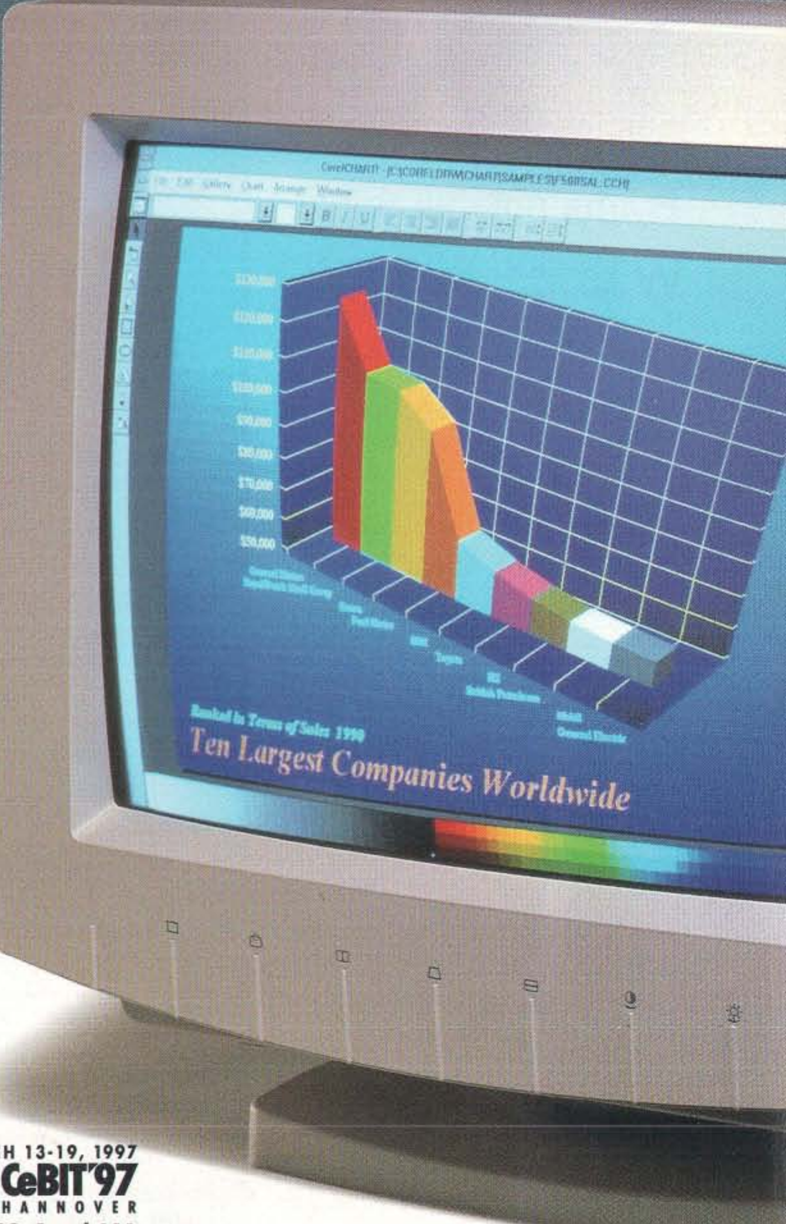
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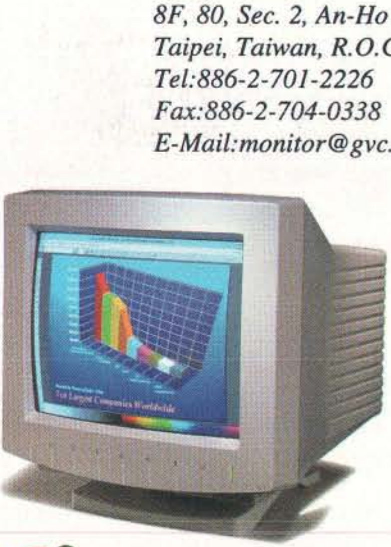

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M1558	15"/0.28	30-56KHz	50-90Hz	1024x768	analog	
M1454	14"/0.28	30-54KHz	50-90Hz	1024x768	digital	
M1568	15"/0.28	30-69KHz	50-90Hz	1280x1024	digital	OSD
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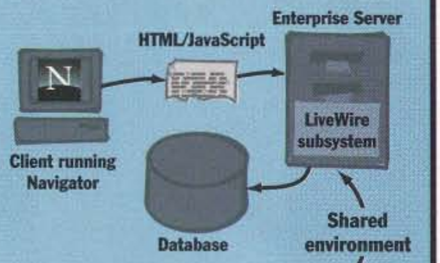
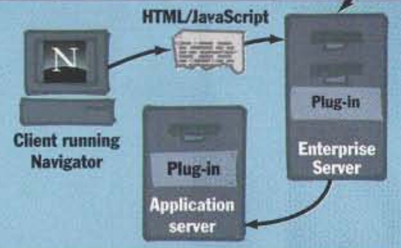
Servers for All Seasons

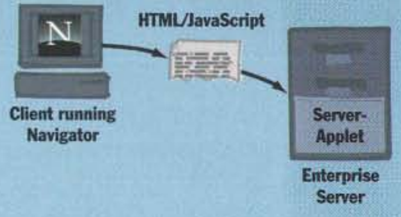
❶ **LiveWire** - An add-on to Enterprise Server 2.0, LiveWire delivered the set of services – scripting, persistent sessions, database access – that have become standard for the new breed of Web development tools.



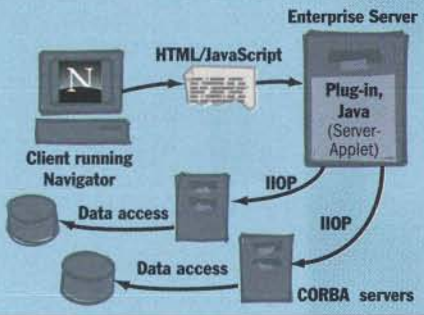
❷ **Server-side LiveConnect** - Enterprise Server 3.0's LiveWire system gains the ability to deploy server plug-ins (SPAPI modules) in conjunction with server-side JavaScript.



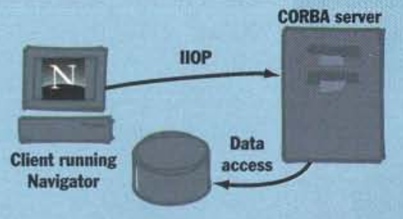
❸ **ServerApplet** - Enterprise Server 2.0's primitive Java mechanism, called HTTPApplet, couldn't integrate with LiveWire. Enterprise Server 3.0's Java mechanism, called ServerApplet, can work alongside JavaScript and plug-ins through LiveConnect.



❹ **CORBA/IIOP** - In Enterprise Server 3.0, plug-ins can be packaged as Common Object Request Broker Architecture (CORBA) objects that communicate through IDL interfaces. These can be deployed on the Web server (in-process or out-of-process) or on a separate application server.



❺ **Direct IIOP** - Thanks to Communicator's embedded Java Object Request Broker (ORB), Netscape clients can bypass the LiveWire subsystem when appropriate and talk directly to CORBA servers over Internet Interoperable ORB Protocol (IIOP).



while Netscape will provide the same IFCs on its servers, your use of client IFCs does not dictate matching IFC-enabled servers. IFCs map down to standard Internet protocols such as LDAP and SMTP, so the purchase-order application could send messages using any servers that support these protocols. Over time, Netscape plans to bind all the IFCs on both clients and servers to Common Object Request Broker Architecture (CORBA) interfaces.

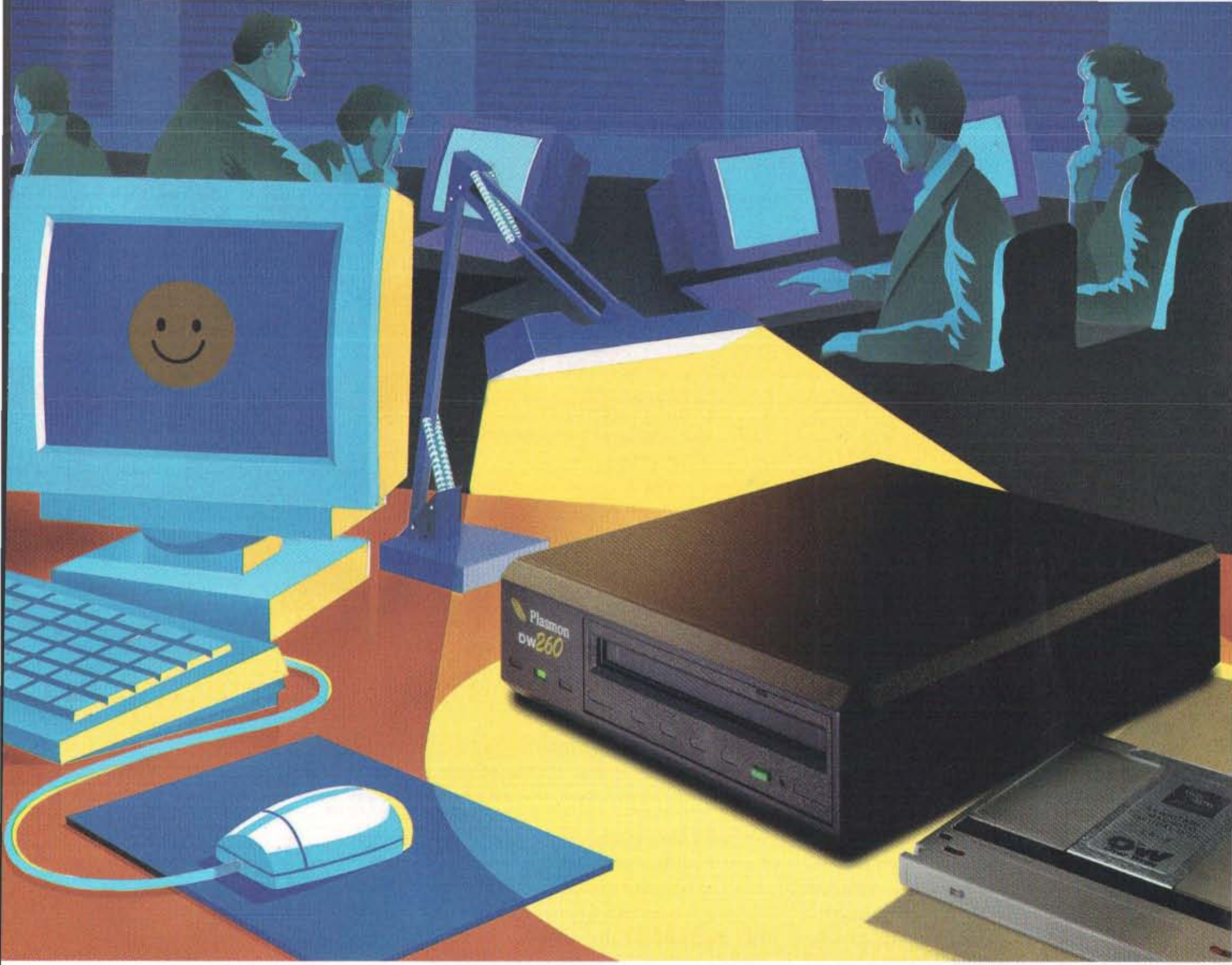
Programmable Server

Web-based software systems have always been client/server systems. They're now rapidly evolving into three-tier systems that cleave presentation services from business logic and business logic from data manipulation. Virtually all the new Web development toolkits, including NetDynamics from the same-name company, Sanga's Sanga Pages, HAHT's HAHTsite, Borland's IntraBuilder, and Bluestone's Sapphire/Web, support this three-tier model. They all provide foundation services such as persistent sessions and database connectivity. Each defines a way to program middle-tier applications, using Java (NetDynamics, Sanga Pages), VBScript (HAHTsite), JavaScript (IntraBuilder), or C++ (Sapphire/Web).

Among the first of this breed of toolkit was Netscape's LiveWire. To program in LiveWire you write a mixture of HTML and JavaScript. Then you use the <server> tag to denote which fragments of code should execute in the LiveWire run-time engine, an Enterprise Server extension that adds application, client, session, and database objects to JavaScript. Developers found the LiveWire system to be highly productive. Inevitably, though, they soon wanted to create their own custom LiveWire objects and build these scriptable components in C++ or Java. They also wanted more flexible ways to deploy middle-tier applications. LiveWire is a Netscape server API (NSAPI) module that runs in Enterprise Server's address space. That's a high-performance solution, but applications are more robust if they can run in their own processes. Similarly, applications are more scalable if these processes can migrate to other machines.

You can extend Netscape's Enterprise Server 2.0 using C/C++, JavaScript, or Java, but these methods are limited, and you can't integrate the different flavors of each module. Version 3.0 promises to blow all the doors wide open. Server plug-ins (aka SPAPI modules) replace NSAPI modules, and these plug-ins will be CORBA-style objects that export interface definition language (IDL) interfaces and speak IIOP. Packaged thusly, they can run in the Enterprise Server's address space or in a separate process that can be local or remote. And developers can write them in any language for which IDL bindings exist. What's more, a server-side implementation of LiveConnect will enable two-way communication between SPAPI plug-ins and Java or JavaScript code, which means plug-ins can become scriptable components just as they can on the client.

You can deploy Java modules called HTTPApplets in Enterprise Server 2.0, but they're of limited use because they can't share the persistence and database services



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CORBA for the Masses

Implementations of the Common Object Request Broker Architecture (CORBA) have been around for years. On the client side, it's supported in OS/2 Warp, OpenDoc for Warp, and the Mac OS, but not yet in Windows. Netscape aims to change that by bundling Visigenic Software's VisiBroker, a Java-based ORB that speaks Internet Interoperable ORB Protocol (IIOP), with Communicator as well as with the SuiteSpot 3.0 servers.

As Netscape users upgrade to Communicator, CORBA's installed base will skyrocket. To whom will this matter? Corporate developers. "CORBA has been more widely accepted than I had expected," says Laird Popkin, director of technology and architecture for The News Corporation's Internet services division. "Everyone is busy wrapping their legacy systems in CORBA IDL [interface definition language]." Why? Though complex, CORBA is a robust and open way to construct enterprise-class networked systems.

The Microsoft counterpart to CORBA, Distributed Common Object Model (DCOM), hasn't shipped yet for Windows 95. And when it does, "there will be a gaping hole in the middle of it," says Jamie Lewis, president of The Burton Group. "DCOM has no directory service, and won't until 1998." Lewis points out, though, that Netscape won't use the CORBA naming service but will instead create IIOP bindings to its own Lightweight Directory Access Protocol (LDAP) directory service. That's a pragmatic move. Full-blown CORBA is a heavyweight system. At this point, Netscape is wise to concentrate on just getting the plumbing widely deployed.

Taking the long view, Netscape's Marc Andreessen sees IIOP subsuming many of today's protocols as the Internet evolves into a sea of object services. If Netscape's FTP sites pump 10 million IIOP-compliant ORBs into circulation this year, the object-oriented Internet could happen sooner than most people think. But there have to be nearer-term practical benefits as well. Here are two:

Bundled ORB is trusted code. Richard Soley, technical director for the Object Management Group (OMG), points out that because Visigenic's ORB is part of Communicator's trusted code base, it can connect to CORBA servers everywhere. Normal Java components, by contrast, can connect only to their servers of origin.

IIOP makes a good target for firewall vendors. A big problem for the "groupware everywhere" vision is that even some of today's core protocols such as POP and NNTP don't penetrate some firewalls. The situation will likely get worse before it improves, as Internet Mail Access Protocol (IMAP), LDAP, and Internet Calendar Access Protocol (ICAP) come online. But if IIOP could encapsulate all these protocols, multiple proxies could consolidate into one on the firewall, and it would be a lot simpler to configure packet-filtering in routers. "If all you care about is the API, then let the IDL compiler build the protocol engines," says the OMG's Soley. What will you do until IIOP proxies become available? You can piggyback IIOP on top of HTTP, though no one pretends this will be very useful.

---

of the LiveWire subsystem. In 3.0, these become ServerApplets, which can use LiveWire objects and can also provide new objects to LiveWire. ServerApplets will also be able to use the directory, messaging, security, and other services available by way of the Internet Foundation Classes. A work-flow module that routes a document would use these services to look up users and transmit messages. It might use IIOP to ask an external document manager to version the document and then invoke a JavaScript-controlled database in order to log the event.

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Netscape's Open Network Environment (ONE) is the sum of three parts: LiveConnect-style integration of Java, JavaScript, and plug-ins; the Internet Foundation Classes; and the CORBA/IIOP model of distributed computing. Netscape plans to materialize ONE in a symmetrical fashion on both clients and servers. "We've committed to putting first IFCs, then later IIOP bindings, onto all the SuiteSpot 3.0 servers," says Eric Hahn, senior vice president of enterprise technology for Netscape. This means that you could, for example, deploy a Java-based message switch on the mail server.

What does the "open" in ONE really mean? It affirms Netscape's commitment to multiple platforms and to Internet standards. Platform neutrality means a lot to developers. News Corporation's Popkin says his team respects and uses NT, but for a site that draws 10 million hits a day, "an Alpha server gives us twice the performance under Digital Unix, and when we tune the kernel we get another factor of two." Internet standards ensure that no one need bet on Netscape alone to advance the state of computing.

In the end, ONE represents a distinctive way to build software, an approach that will work first and best with Netscape clients and servers. It's radically at odds with the Microsoft way, and the stakes couldn't be higher. These two companies are battling to define how the fabric of business networks will be woven. Netscape's plan assumes platform diversity, while Microsoft's expects Windows to be everywhere and sees the Distributed Common Object Model (DCOM) as the obvious technology for distributed applications. But some companies consider this another case of Windows myopia. "The fact is that most apps will have to face the Internet and extranets," says Jens Christensen, chief technology officer for Visigenic, a CORBA-compliant ORB developer. "It's not likely you'll find a DCOM environment on the other side."

So long as diversity prevails on the Internet, Netscape will continue to be a prime mover.

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*Jon Udell (***judell@bix.com***) is BYTE's executive editor for new media.*

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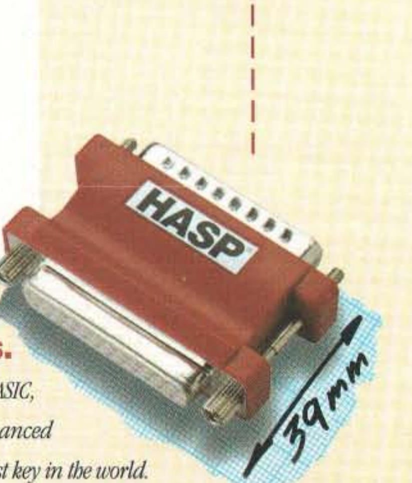

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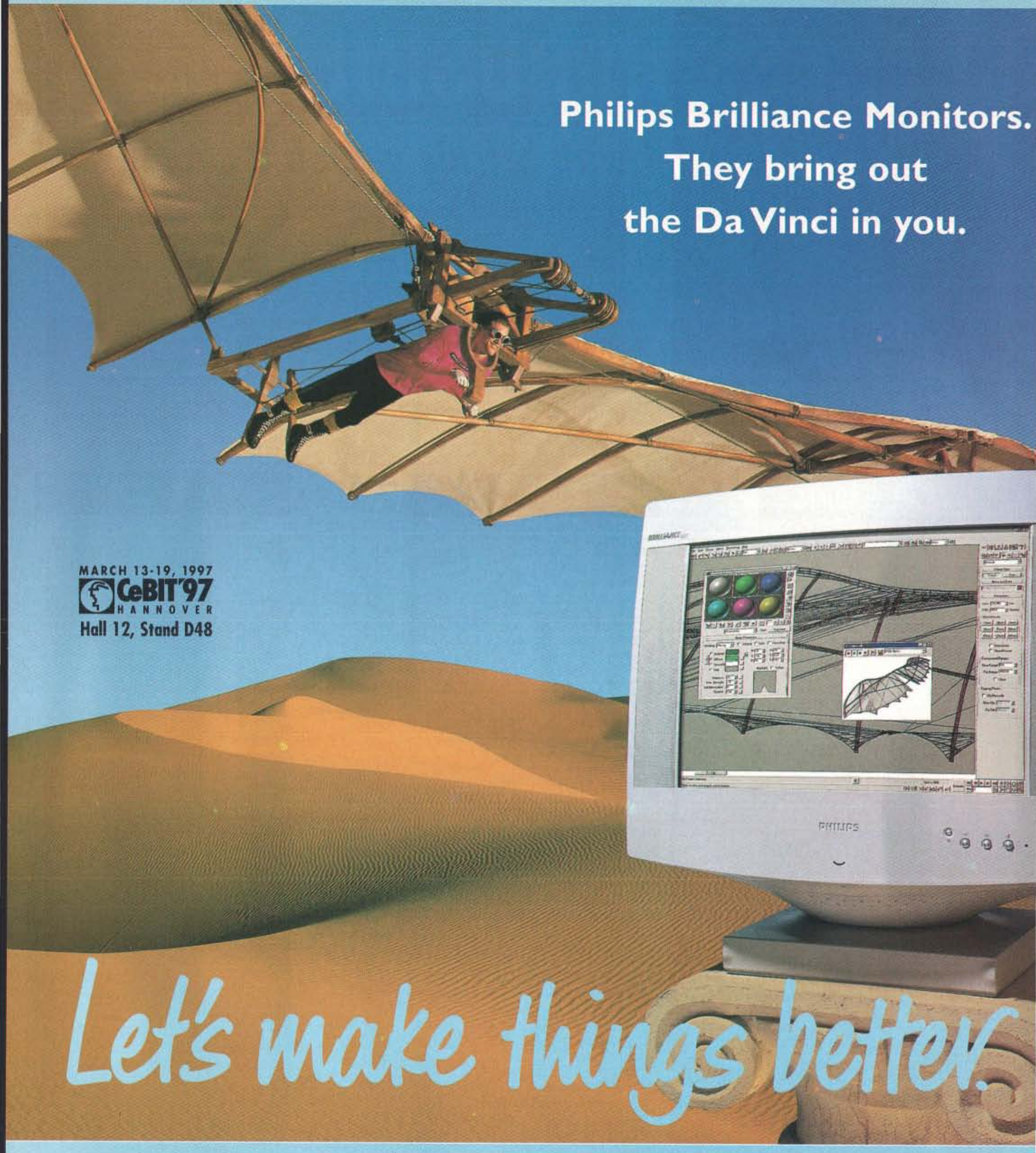

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SCSI is out, serial is in. How will the battle among USB, FireWire, Fibre Channel, and SSA end?

By Mike Hurwicz

"The year 2000, plus or minus a year, will be a bloody disaster," claims Dal Allan, founder of ENDL Consulting (Saratoga, CA). We already know about the date problem, but Allan has another reason to worry: peripheral interfaces. We're rapidly outgrowing SCSI—even the 40-MBps Ultra-SCSI—but the industry hasn't settled on what will come next.

The problem isn't that we don't have alternatives; it's that we have too many—universal serial bus (USB), Serial Storage Architecture (SSA), FireWire, and Fibre Channel–Arbitrated Loop (FC-AL). Each one has something to recommend it, but they aren't interchangeable.

I won't keep you in suspense here: A system you buy in two years is likely to have a couple of these buses. USB is really too slow for much more than keyboards, mice, printers, and modems. FireWire is faster, but it's best suited for digital peripherals (e.g., cameras, VCRs, and the like). SSA is plenty fast, but it's shaping up to be something you find only in IBM shops.

In the end, it's likely that a form of FC-AL will be your high-speed storage connection. What follows is an explanation of how I came to those conclusions.

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Why Serial?

Blame SCSI's problems on the PCI bus. Until PCI arrived on the scene, SCSI seemed impressively fast. But compared to a 33-MHz PCI bus with a raw transfer rate of 132 MBps or a 66-MHz PCI bus running at 524 MBps, SCSI-1 and SCSI-2's measly 5 MBps pales.

So why not just make SCSI faster? That way you could keep at least some level of compatibility. No problem: You can already get 80 MBps from an Adaptec dual-channel ultrawide SCSI adapter. And the ANSI XT310 committee is discussing Ultra-SCSI-2 at 80 MBps and Ultra-SCSI-3 at 160 MBps.

But sooner or later you start encroaching on certain laws of physics. Here's why: There are two ways to increase the transfer rate of an interface. You can add more links or speed up the existing links. But both have problems. If you add more wires (and you'd have to add *lots* more), you'd create an unmanageably thick cable. (A standard SCSI cable already has 50 wires, and a wide SCSI cable has 68.) If you speed up the link, on the other hand, you'd make *clocking*—deciding where one bit ends and the next starts—increasingly difficult for devices on the bus. The acceptable margin of error in clocking becomes smaller as the interface gets faster and the bits get shorter. When multiple lines have to be clocked in parallel, a mismatch is also possible between lines. Making SCSI faster just seems like more trouble than it's worth.

Recognizing that any radically different approach would take years to get off the ground, engineers began looking for other approaches that had more growth potential than SCSI. The answer seemed to be serial. Serial interfaces transfer just one bit at a time on just one line. (A full-duplex serial interface transfers one bit at a time in each direction, but on two separate lines.)

In addition, serial interfaces eliminate the possibility of a mismatch between lines, because the clock information is in the same stream as the data. Also, serial interfaces offer simple wiring between the peripheral and the computer: just two wires per line. Therefore, a full-duplex serial interface requires only a four-wire cable.

So, in summary, serial can go fast, and the cables can be thin. But once the engineers got that far, they started to take some radically different tacks.

USB: Parallel Replacement

Although slower than SCSI, the 12-Mbps (1.5-MBps) USB interface offers both higher speeds and Plug and Play capabilities for peripherals that previously would have used the serial or parallel port or a special port, such as the one for a keyboard, mouse, or monitor. USB can also be used for a small number of peripherals, such as scanners, that in the past used SCSI or proprietary adapters.

For non-SCSI peripherals, USB offers performance that's over 100 times faster than the 115-Kbps maximum of the traditional serial port, for instance. The parallel port generally has a maximum rate of about 2 Mbps, about six times slower than USB.

In addition, up to 126 devices can be daisy-chained through USB hubs to a single USB port—without requiring any added computer resources, such as IRQs. In contrast, a serial, parallel, keyboard, or monitor port typically supports just one device. Moreover, low-power USB devices can get electrical power through the bus, reducing the need for wall outlets or power-distribution bars. (High-power devices, such as scanners, still need an outlet.)

USB also permits *hot swapping*—the ability to remove and replace devices without the need to turn off the PC. Devices such as keyboards and mice, which feature two-way communications, cannot be reliably hot-swapped today. Finally, there is one standard cable for all USB devices, making cable replacement easier and less expensive.

However, the first USB chips became available from Intel and National Semiconductor only in late 1996. Some chips, such as USB hub controllers, won't be available in volume until the second quarter of this year.

The availability of chips is certainly a major factor in the rollout of USB products. Equally important, though, is availability from Microsoft of *class drivers*—software modules that offer support in Windows for each type of USB device. Microsoft has begun releasing class drivers for Windows 95, the first being a driver for digital cameras. Class drivers for Windows NT aren't expected until release 5.0, which isn't expected until late this year.

USB is designed for low- and medium-speed devices, such as monitors, keyboards, printers, mice, modems, and scanners. As far as storage devices go, it can be used for those that connect to parallel ports today, such as removable cartridge and tape drives. However, USB is simply not designed for high-speed devices or applications. That's where SSA, Fibre Channel–Arbitrated Loop (FC-AL), and FireWire come in.

UNIVERSAL SERIAL BUS (USB)

Use: Low- and medium-speed peripherals that use serial, parallel, or mouse ports today
Throughput: 1.5 MBps
Cable length: 5 meters
Maximum devices: 126 devices daisy-chained (three per hub controller)

SSA: IBM's Storage Entry

As recently as mid-1995, it looked as if IBM would succeed in promoting SSA as an alternative to SCSI. IBM's main selling points for SSA over SCSI were speed and cabling: SSA offers two full-duplex channels, each running at 20 MBps in each direction, for a total maximum transfer rate of 80 MBps—double that of Ultra-SCSI. And the SSA cable has just four wires—two twisted pairs, one pair for each channel.

By 1995, an ANSI committee (X3T10.1) had been working on a formal SSA standard for two years, and the SSA Industry Association boasted more than 40 member companies. Chips were available from IBM. Pathlight Technology (Ithaca, NY) had SSA adapters for OEMs. Conner Peripherals (San Jose, CA) was on-board to support the interface in its disk drives.

However, SSA's promise as an OEM technology was never fulfilled. "The bottom line on SSA," says Allan, "was that after two years of hoped-for big OEM wins, nobody ever got one. SSA offered no extra bang per buck over SCSI when like systems were compared."

The problem was with the number of DMA lines required. The 80-MBps transfer rate for SSA, notes Allan, assumes that there's data all the time on four 20-MBps DMA lines. "If you hooked up four SCSI adapters (which would take four DMAs), you get 160 MBps, which leaves SSA in the dust," he explains. "And a four-DMA SSA card is more expensive than four SCSI adapters."

In October 1995, Seagate acquired Conner. Seagate, which is a partisan of FC-AL, then quietly buried SSA. (The official announcement that Seagate was discontinuing development on SSA came in February 1996.) Faced with a lack of support from the world's largest drive manufacturer, other players, such as drive manufacturer Micropolis, also backed away from SSA. Adaptec (Milpitas, CA), seeing that SSA was emerging as an IBM-only technology, shelved its plans to support the interface.

SSA has technical limitations, too. Hybinette, a Boulder, Colorado–based integrator specializing in assembling high-performance Alpha-based servers for the graphics industry, intended to release a line of shared SSA disk arrays with PCI controller cards. However, when trying to share the disk arrays, they had file-corruption problems, and the only cures the company could find were a $3000-a-seat software package or a hardware-based switching scheme. Both were much too expensive, says VP of Sales Bob Simpson. Furthermore, Hybinette found it could achieve only 5 MBps when dedicating an SSA disk to its Alpha-based server.

IBM now offers several four-port SSA adapters for the RS/6000, as well as two high-performance, high-capacity disk subsystems, the 7131 SSA Multi-Storage Tower and the 7133 SSA Disk Subsystem. IBM has also signed OEM deals with La Cie and Groupe Bull.

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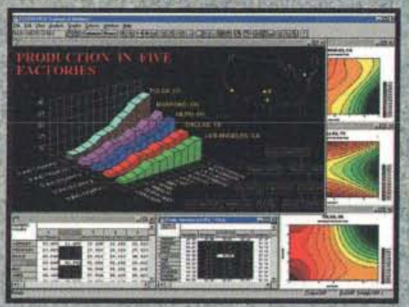

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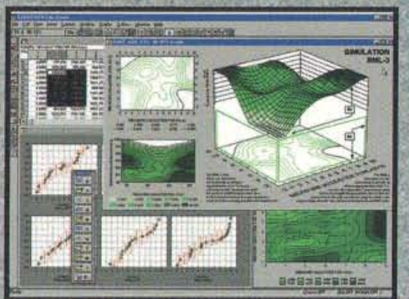

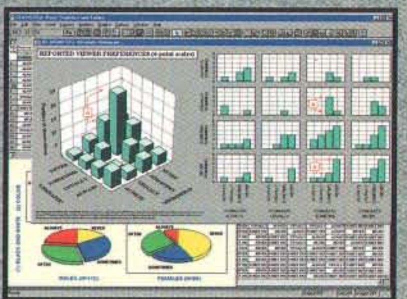

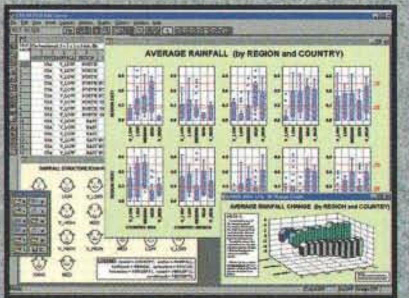
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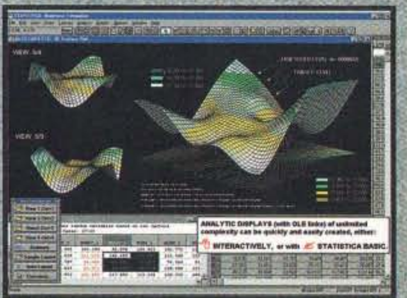

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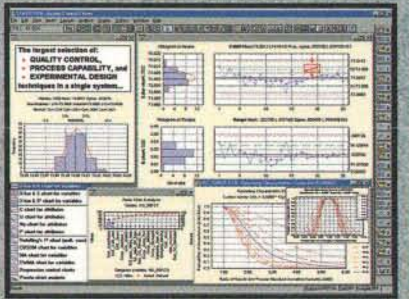

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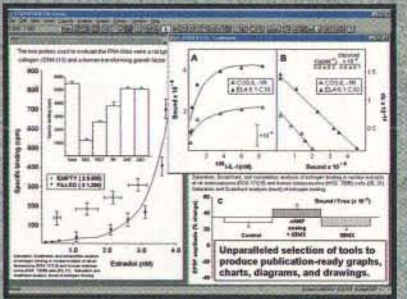

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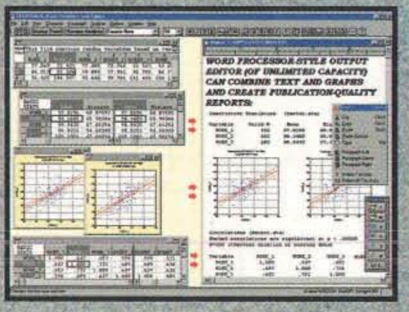

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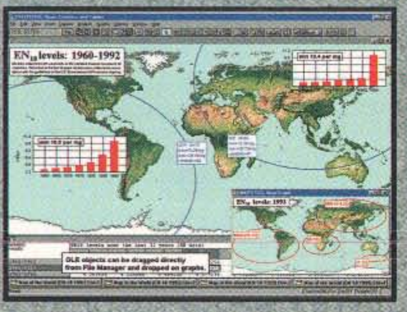

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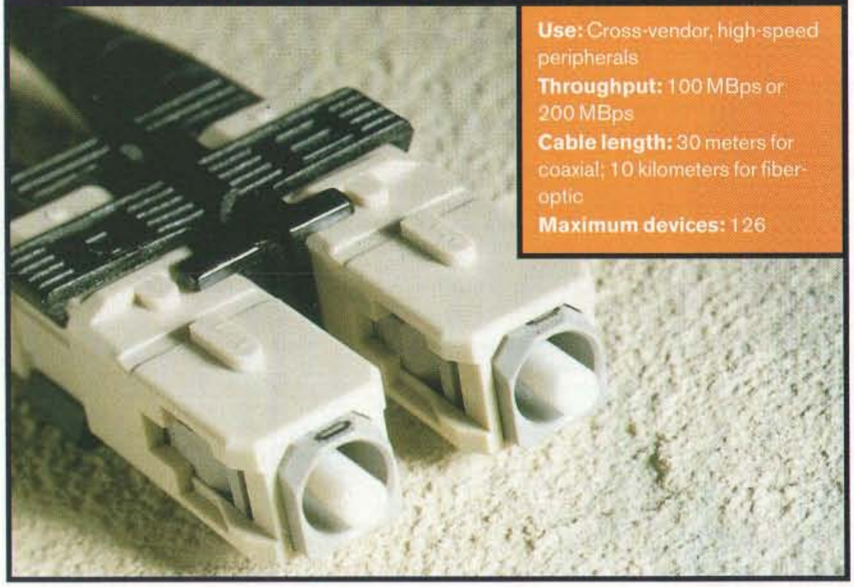
IBM is still solidly behind SSA. It's even planning a next generation, due to appear in 1998, that doubles link speeds for a total throughput of 160 MBps, according to Bill Pinkerton, director of marketing for open systems storage in IBM's Storage Systems Division in San Jose, California. However, SSA is a technology with a limited lifetime: It will be subsumed in the next generation of Fibre Channel.

FC-AL: 100 MBps and Up

FC-AL offers a substantial bandwidth improvement over SCSI. FC-AL's base speed is 100 MBps. However, a large number of products are dual-ported designs offering a total bandwidth of 200 MBps. Dual porting also increases fault tolerance by offering redundant access to each device. Base speeds of 200, 400, and 800 MBps and higher are expected during the coming years. In short, FC-AL is starting out, and will probably always be, more than twice as fast as the fastest SCSI available.

As if that's not enough, there are three more things to make you put FC-AL on your early Christmas shopping list. First, FC-AL is self-configuring and enables you to hot-plug devices. Second, many host computers already support FC-AL for host-to-host interconnection. Third, FC-AL supports cables up to 30 meters long with coaxial cable, or 10 kilometers with fiber-optic cable. And there are already twisted-pair products available, such as the FibreNet line of cards and disk arrays from Transoft (Santa Barbara, CA) that support runs up to 65 feet.

FIBRE CHANNEL–ARBITRATED LOOP (FC-AL)



Use: Cross-vendor, high-speed peripherals
Throughput: 100 MBps or 200 MBps
Cable length: 30 meters for coaxial; 10 kilometers for fiber-optic
Maximum devices: 126

FC-AL supports the major peripheral command interfaces, including SCSI-3, High Performance Peripheral Interface (HIPPI), and Intelligent Peripheral Interface (IPI-3), minimizing the need for software changes. The only standard command set supported by SCSI is SCSI itself. Also, you can connect an amazing 126 devices to a single FC-AL port; a single SCSI bus can support only 15 devices.

FC-AL primarily targets high-end server applications, where you need all the performance that you can possibly get and where FC-AL's fault tolerance is a major selling point. Superlong cable runs also have some special applications in this arena, such as putting mirrored disks in two separate buildings for additional disaster protection.

SERIAL STORAGE ARCHITECTURE (SSA)

Use: Primarily for IBM's high-end peripherals
Throughput: 80 MBps
Cable length: 25 meters between devices
Maximum devices: 48 per loop

There are three reasons why FC-AL is not emerging as a favorite for specialized desktop/consumer applications (video editing, for example). First, a single-user desktop application running on a standard Intel box might not be able to take advantage of FC-AL's speed. (That will change as platforms evolve; many industry experts expect to see FC-AL on desktops by the year 2000.) Second, fault tolerance and disaster protection are not as critical for the desktop/consumer market. Finally, the largest segment of the single-user market, the consumer category, is extremely cost-sensitive, and FC-AL is shaping up to be a bit costly.

FCL: FC-AL + SSA

In September 1996, controller manufacturer Adaptec, IBM's Storage Systems Division, and Seagate announced they would merge FC-AL and SSA into a specification that is now being called Fibre Channel Loop (FCL). (It was initially called Fibre Channel–Enhanced Loop.) With this agreement, IBM effectively admitted that FC-AL had defeated SSA.

But the FCL specification is still in the hand-waving stage. "FCL doesn't really exist," says Joel Warford, business development manager for Adaptec's Mission Critical Subsystems business unit. "It's just sort of a code word for a future serial interconnect that merges the best of Fibre Channel and SSA. Products are years away.

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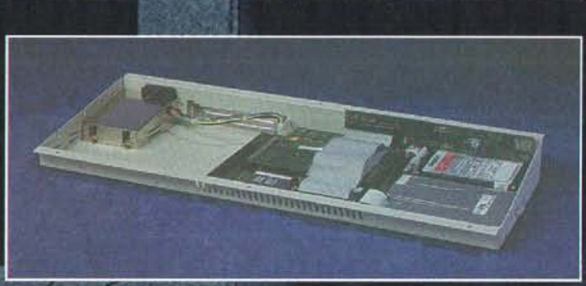

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Some manufacturers will lead the market in late 1998 and 1999. Others will wait until 2002. It's far enough out that it's difficult to say, but FCL may be a mainstream technology around the year 2000."

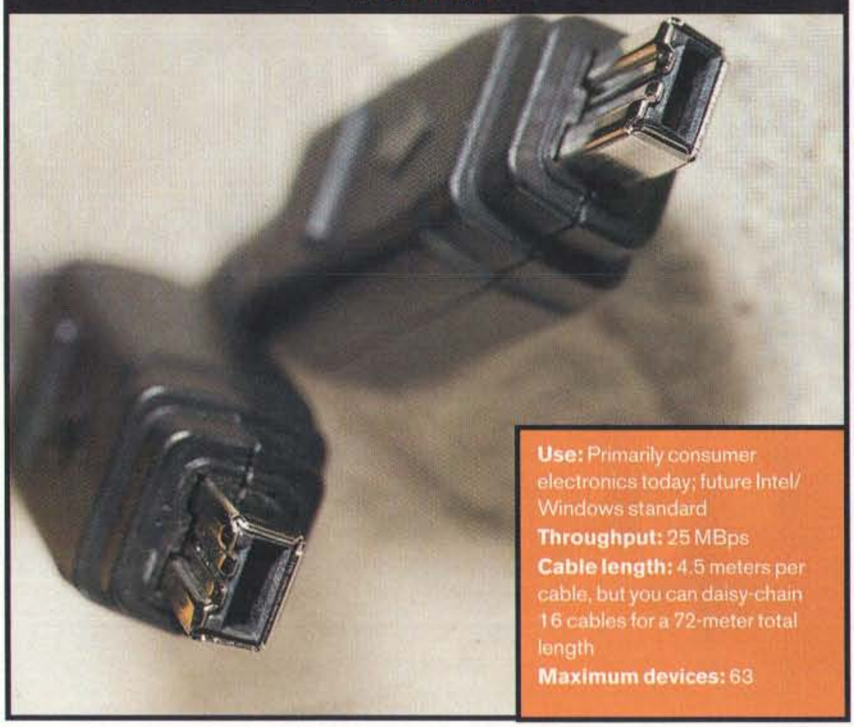
FCL is a great deal closer to FC-AL than to SSA. For instance, FCL offers a base speed of 100 MBps—the same as FC-AL. The FCL proposal was submitted to the ANSI X3T11 committee, the one responsible for Fibre Channel. Backward compatibility with FC-AL will be handled through a dual-mode capability, in which the same interface will have the ability to accommodate FC-AL and FCL devices alike. In contrast, SSA devices will not be able to connect directly to an FCL interface. Backward compatibility will have to be handled through combination adapters that have both interfaces on them, such as a gateway.

SSA's probable contributions include *spatial-reuse* and an *arbitrationless* architecture. Spatial reuse allows drives on an SSA loop to talk directly to one another independently of the computer system or the SSA controller. An arbitrationless architecture allows multiple drives to talk to the bus at the same time.

FireWire: Video Va-Voom

FireWire (IEEE 1394) offers some of FC-AL's benefits, such as hot-pluggability and slim cables. But FireWire is also substantially slower than FC-AL. The current 1394 standard (1394-1995) supports data transfer rates of 100, 200, and 400 Mbps, or 12.5, 25, and 50 MBps, respectively.

FIREWIRE



Use: Primarily consumer electronics today; future Intel/Windows standard
Throughput: 25 MBps
Cable length: 4.5 meters per cable, but you can daisy-chain 16 cables for a 72-meter total length
Maximum devices: 63

FireWire is inferior to FC-AL in a number of other ways as well. For instance, it currently supports only 63 devices on a single bus and cable lengths among devices up to 14 feet. Neither of those limitations is likely to matter much in a single-user application.

On the other hand, FireWire has characteristics that make it more attractive than FC-AL for certain applications, such as consumer and "prosumer" digital imaging. This is no accident: These are exactly the types of applications for which FireWire was originally designed.

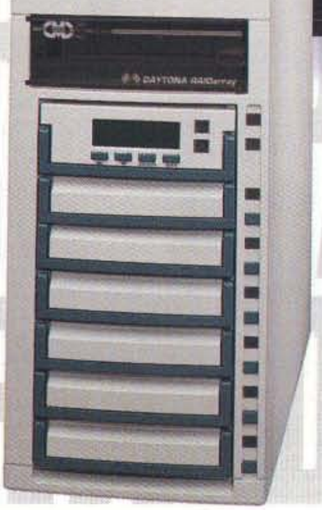
SCSI

Use: Current standard; parallel (not serial); high-end peripherals
Throughput: 5 MBps (SCSI-2); 40 MBps (Ultra-SCSI)
Cable length: 3 meters; 25 meters for differential SCSI
Maximum devices: Eight for Ultra-SCSI; 16 for wide Ultra-SCSI

In the last half of 1996, IBM brought out 200-Mbps FireWire transceiver chips, and Adaptec and Skipstone (Austin, TX) brought out 200 Mbps FireWire boards for OEMs. Adaptec should have FireWire PCI boards for end users early this year, for a price of around $350 to $400—about the same as the price of a high-end SCSI board. FC-AL boards, in contrast, will be closer to $1000, according to Adaptec's Warford. (On the other hand, QLogic displayed a Fibre Channel adapter at Fall Comdex that it expected to sell for about $500.) Adaptec and Skipstone also announced partnerships with digital-video-editing product vendors for products to appear in the first half of this year. Both vendors expect to have 400-Mbps FireWire products late this year.

Compaq, Intel, and Microsoft are all supporting FireWire as a strategic interface. Most observers expect FireWire to appear on Intel motherboards around 1998. "You may see some in 1997," says Allan, "but they have to give disk manufacturers time to switch over to 1394. So, they'll have to leave the current hard disk interfaces in there as well."

Initial FireWire peripherals will include tape decks, digital camcorders, and



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digital videodisc (DVD) players. No drive manufacturers have yet announced FireWire products.

In spring 1996, a FireWire splinter group formed: the 1394.2 study group. The group's mission is to create a version of 1394 that can sustain data transfer rates of 100 to 400 MBps, using fiber-optic cable rather than copper wire. Apple, Intel, and Sun have all been promoters of the proposed new specification.

Unfortunately, 1394.2 is incompatible with the current version of FireWire at the physical-interface level. If you have a device (e.g., a digital videocamera) with a 1394-1995 port, you'd need a bridging device to connect it to a microcomputer with a 1394.2 port, for instance.

The companies that have staked their fortunes on 1394-1995 (which is also known as 1394a or 1394.0) are not overjoyed at the emergence of a physically incompatible standard, which would raise prices in a highly cost-sensitive market. They are currently looking into ways of getting 800 Mbps or even 1600 Mbps (that is, equaling or surpassing the 1394.2 proposal) while maintaining physical compatibility. "We see 1394.2 as being more for server/workstation applications, including clustering," says Steve Timm, Microsoft's 1394 evangelist, "not for volume PC applications. The industry is splintered on that. But 1394.2 doesn't have wide industry support as a motherboard standard. For storage applications, there is a lot of support for making sure that the solution is backward-compatible."

However this battle plays out, the same software will be able to interface to either flavor of 1394 transparently.

SCSI Isn't Dead—Yet

Of course, something as entrenched as SCSI doesn't just dry up and blow away. For a while, SCSI will keep the bulk of its current market—low- to medium-performance disks. The serial interfaces will divide the spoils as follows: USB gets the mundane things (mice, keyboards, modems, and so on), FC-AL gets disk storage for high-end servers and workstations, and FireWire gets the fun stuff (e.g., digital video cameras, digital videodisc players, and the like).

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In the end, FireWire or Fibre Channel (or both) will supplant SCSI. FireWire will get a boost if it comes free on the motherboard—especially if it's an 800-Mbps version. From the other side, there's no sign that Fibre Channel prices will come down enough to take any serious market share away from SCSI anytime before the year 2000.

According to Sundi Sundaresh, vice president and general manager for the personal I/O business at Adaptec, "The future of I/O is serial. The question is how long parallel technology will last after the year 2000." ■

Mike Hurwicz (Brooklyn, NY) is a writer and consultant specializing in networking. You can contact him by sending e-mail to **editors@bix.com.**

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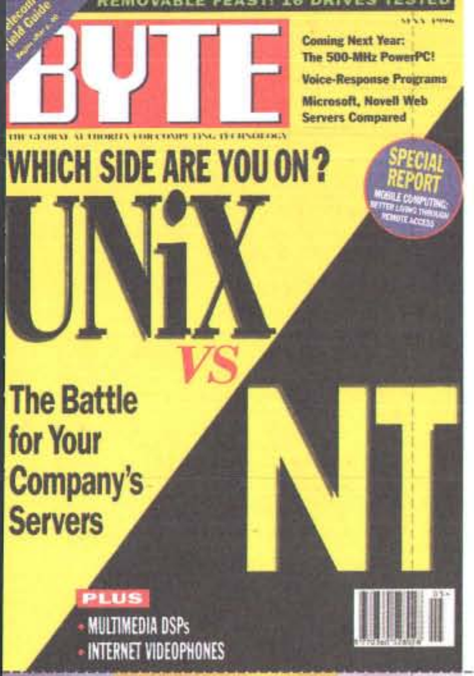
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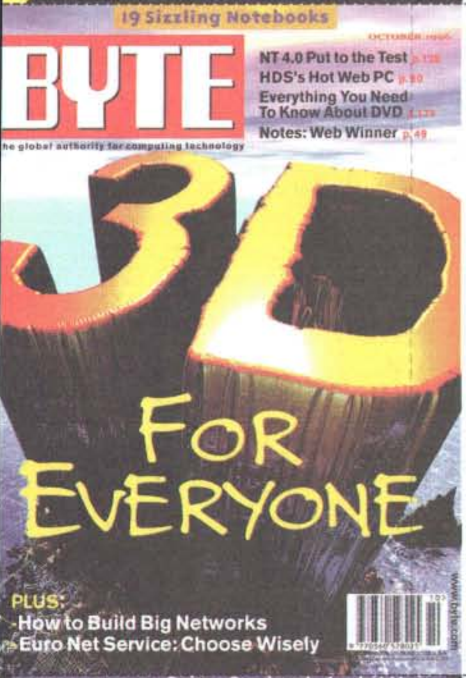
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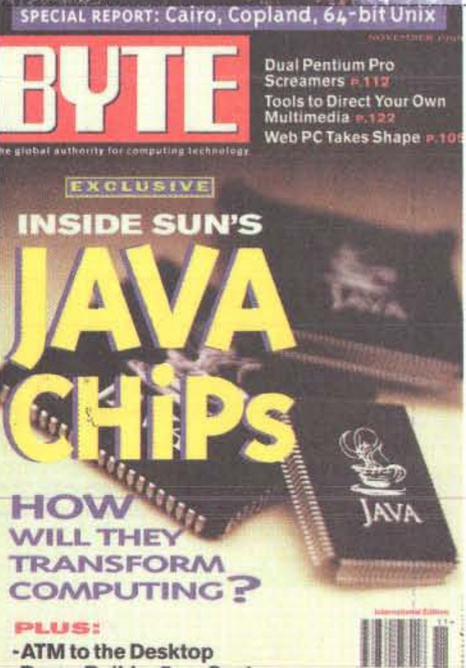
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Internationalizing code from the start minimizes costs and leads to big payoffs.

By Holly Hubbard Preston and Udo Flohr

In the same way that little software companies often become big ones, domestically oriented software companies often become internationally competitive. The problem is that while many independent software companies like to think big, they do not always like to think international. There's a good reason for this. It's costly to localize and translate a software application—and its related documentation—for an overseas market.

Berlitz Translation Services, a division of the international language-services giant, estimates that its software-developer clientele pay anywhere from $50,000 to $100,000 or more to fully localize and translate a product for a single language. Microsoft places its translation and localization costs at as much as $300,000 or more, depending on complexity.

The process is also time-consuming. Companies spend an average of six months to a year to prepare a localized-language version of software. This includes bringing in localization experts to check for technical, cultural, and lingual accuracy.

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Money Makes Money

If it is such a hassle, why bother? Companies do it because selling localized-language versions is big business. The Software Publishers Association (Washington, DC) estimates that of the more than $28.7 billion in packaged business software sold in 1995, 60 percent of those sales were outside the U.S.

For many software companies, a global product strategy is akin to planning a building in which you will house your company five years from now. While you might not need the opportunity today, will you tomorrow? As Orlando Ayala, Microsoft's vice president in charge of intercontinental sales and marketing, notes: "There is a very direct relationship between growth and the ability to produce localized versions." Over 50 percent of the company's more than $8 billion (fiscal 1996) revenues came from outside the U.S.

Although tempted by the opportunity to make money offshore, many independent software developers opt to focus their sole attention on creating an English-language version of their software. It is only when that software is selling strongly in the U.S. market that they start to think about localizing their product for other markets. While such an approach may save money in the near term, it can prove to be costly over the long haul. An English-language software application *not* written with a foreign-language port in mind means that the developer will not only localize the software but also rewrite a significant portion of its code. Meanwhile, your better-prepared competition beats you.

Preparing for World Markets

Thanks to key developments in OS software, in the evolution of Unicode (see "Unicode Evolves" on page 105), and in other areas, independent developers now have more opportunities to prepare their products for localization long before they even think of stepping out of the country or their home state.

While support for Unicode in OSes and other developments make it easier for an independent software company to plan for future localization, they by no means ensure success. It is critical that developers lay some groundwork of their own at the code level to ensure that their product is fully Unicode-compliant and has enough extensibility to sell overseas. Here's what the specialists at Berlitz Translation Services say developers need to be aware of when writing English-language versions of their product:

1. Be sure your application is Unicode-enabled, meaning that it can accommodate single-byte (e.g., Arabic, Hebrew, and Cyrillic),

double-byte (e.g., Chinese and Japanese), and Roman character sets.
2. Understand exactly what the OS you intend to write for supports as far as Unicode features. Different versions of the OS may have done different things with Unicode.
3. Do not make assumptions that your printer and display drivers can accommodate Unicode in final output. For instance, some character sets when displayed read from right-to-left or from the bottom of the screen to the top.
4. Avoid hard-coding certain standard items such as input fields, fixed character width, dialog boxes, and help definitions. Your application will need flexibility. Foreign languages tend to take 20 percent more space than English.
5. Avoid string concatenation. Separate strings of precoded phrases don't come together the same way in one language that they do in others. For example, stringing together the local string for "file," the local string for "error," and the local string for "has occurred" may not give the local string for "file error has occurred."

The key point to following these steps is to make sure that, as a developer, you are aware of what you need, API-wise, to go global long before you do. Developers who don't follow these steps will have a difficult time localizing their code for different parts of the world. There are too many idiosyncrasies from one country to the next to be ready to localize a product on an ad hoc basis.

Your globalization chores will become easier if you focus on the areas mentioned in the following sections.

–H.H.P.

Coding Practices That Make Localization Easier

- Use Unicode for all character processing.
- For any non-Unicode data (e.g., fonts and code page numbers), do not hard-code.
- Isolate code functions that require script-specific modification.
- Avoid hard-coding user-visible strings. Use resource files instead.
- Avoid run-time concatenation.

Get Help from the OS

Developers should make their application as culturally and human-language independent as possible. The OS can help them. Rather than writing quick-and-dirty language-dependent code first and then rewriting it later, programmers should use the routines provided as part of the OS for tasks such as text input and output. Apple's Macintosh Toolbox was the first to provide this type of service, but Windows and Unix environments have long since stepped up to the same standards. Just as Windows programmers don't have to write their own printer drivers anymore, there is no need to try to handle double-byte character I/O "manually."

Thanks to these developments on the OS front, independent developers now have more localization options. Among the most important developments is the agreement between leading software companies for a Unicode character-encoding specification that provides OS-level support to multiple-byte as well as single-byte character sets.

Another key development taking place is that OS giants such as Microsoft and Apple are in the process of further streamlining localization into their overall product-development efforts. For instance, Microsoft is centralizing product development so that localization experts, programmers, and product managers work in tandem rather than in phases.

Apple, currently overhauling its Mac OS strategy, is creating a Software Development Kit (SDK) that will make localization support automatic as opposed to optional. **–U.F.**

Stick to the Script

International development efforts usually revolve around text output in the target language's writing system. What do users want and expect? Character codes, fonts, and scripts are good places to find the answers.

A writing system, also called script, consists of rules for creating a visual representation of language and an accompanying character set. More than 30 character sets are in use today throughout the world, including Chinese, Arabic, Roman (for English), Cyrillic, Japanese, and Hebrew.

These systems differ in their approaches for creating graphic representation of words. In alphabetic scripts such as Roman, Greek, and Cyrillic, the characters typically stand for the basic sounds (i.e., phonemes) of the corresponding language. In syllabic systems (e.g., Japanese kana), characters represent syllables. Complex scripts, such as Chinese Hanzi and Japanese kanji, use up to 30,000 ideographic characters: They stand for sounds and incorporate meanings of words.

Sorting Scripts

From a programmer's technical perspective, you first need to categorize scripts according to their unique characteristics as follows:

- Simple scripts, such as Roman and Cyrillic, use left-to-right lines and fill pages top-to-bottom. With fewer than 256 characters, you can represent each in a single byte. They do not need context information.

- Complex scripts with large character sets (e.g., for the languages of China, Japan, and Korea) need 2 bytes for each character. There usually are no spaces between words. For direction, they use different combinations, including top-to-bottom lines, left-to-right lines, right-to-left pages, and top-to-bottom pages. (Periodicals are usually printed in vertical columns, while technical documents are often displayed in left-to-right lines.) These scripts do not require context information. The characters

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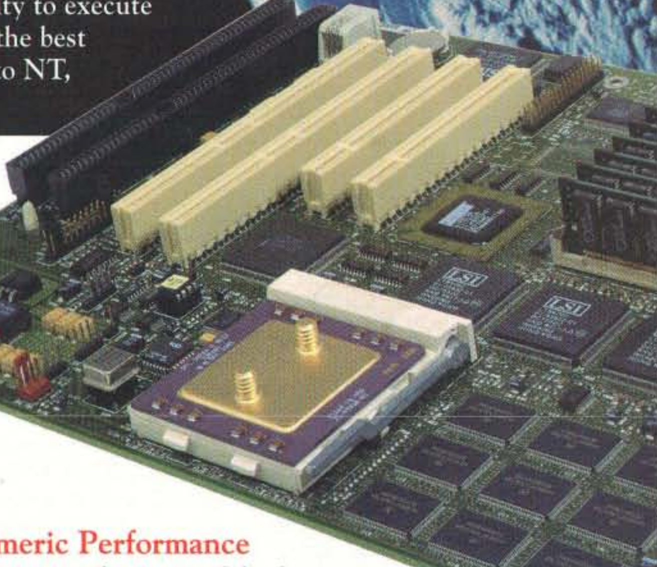

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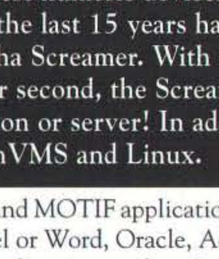

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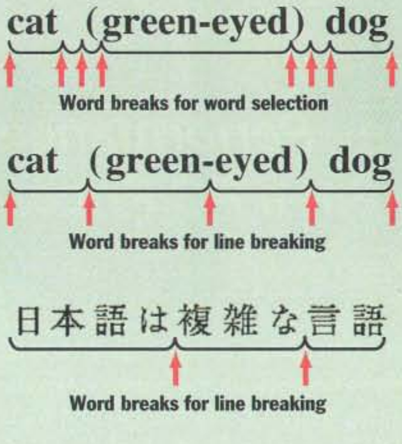
may have no sorting order that would correspond to alphabetic sorting in the less complex scripts and may also have no uppercase or lowercase.

- Context-sensitive systems will also use fewer than 256 characters, but a character may look different depending on its context (i.e., the surrounding characters). This is similar to handwritten Roman text. An Arabic letter has up to four possible shapes (i.e., glyphs). While typing Arabic text, previously entered characters change in appearance.

- Bidirectional scripts, such as Arabic and Hebrew, use right-to-left as their main direction, but numbers and interspersed words from Roman scripts are written left-to-right. They have fewer than 256 characters. Hebrew is context-independent; Arabic is both bidirectional and context-sensitive.

Split Personalities


cat (green-eyed) dog
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cat (green-eyed) dog
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Word breaks for line breaking

Scripts consist of rules for creating a visual representation of language and an accompanying character set. The more than 30 character sets in use today for creating graphic representation of words use widely varying rules, which presents technical problems for programmers. English-speaking programmers who are used to breaking sentences between words or after a hyphen (see the top two lines at the left) must create special algorithms for complex scripts, such as Chinese, Japanese, or Korean. There usually are no spaces between words in these languages. For example, in Japanese (the bottom line at the left), line breaks can occur within a word, but multicharacter symbols cannot be split.

Cluster Control

Some scripts, such as Thai, Korean, and Hebrew, have character clusters. This phenomenon, which is similar to but more complex than something such as accents in French or Spanish, requires special consideration from the programmer. Highlighting and deleting text, as well as the movement of the insertion cursor, have to treat the clusters as single characters. Clusters can have up to five components.

Globalization Glossary

Character code: A unique integer value that signifies a character in a script.

Character orientation: The rotation of the characters in relation to the script's line orientation. It is called with-stream when it goes in the same direction as the line orientation and cross-stream otherwise. Horizontal line orientations (left-to-right or right-to-left) usually lead to with-stream character orientation. Vertical line orientation (top-to-bottom) yields cross-stream most of the time, but with-stream (i.e., a vertical character baseline, a 90-degree rotation) is also possible.

Encoding: The mapping between characters (i.e., the character set) and their character codes, which are unique integers. Sometimes a character appears in different character sets or more than once in the same character set; this is because the same character can be used differently in another script. An example is the character *H*, which is used differently in Roman than in Cyrillic.

Glyph: The shape of a character. In context-sensitive scripts, it depends on the surrounding characters.

I18n, L10n: Even in an acronym-laden industry such as this, these two have to be among the crankiest. I18n stands for internationalization; the 18 signifies the number of characters between the *i* and the *n*. L10n is, similarly, localization. Many people argue that cryptic acronyms such as these defy the very purpose of globalization.

Internationalization: Preparing a product for international markets while retaining it as a single version; that is, it does not yet contain features that apply to only one language or script. Thorough internationalization, as a first step, saves cost in the next stage, which is localization.

Line orientation: The text flow direction within a line. For instance, Arabic generally uses right-to-left line orientation. In Japanese, it is either top-to-bottom or left-to-right.

Localization: Preparing a product for a single locale. This usually involves translating the user interface and documentation and adapting time, date, and number formats. However, it often doesn't stop there. The different script may require more dramatic changes, and sometimes icons, symbols, metaphors, and even concepts have to be reconsidered.

Script: A writing system for creating a visual representation of language. It consists of a set of characters and rules on how to combine them. Examples for scripts are Chinese, Arabic, and Roman.

Ligatures are a special case of clusters. In Roman scripts, it's usually a sequence of two characters that acts as a unit. To capitalize a ligature, for example at the beginning of a sentence, both characters must change to uppercase.

Boundary Markers

Even if there are no clusters, character and word demarcation—finding boundaries between words and characters—can be challenging. For example, even in a seemingly simple Roman text, we do not break lines directly before most punctuation marks; but it is OK to break the line before an opening parenthesis. In bidirectional scripts, this is more complex.

In many Asian systems, there are no word delimiters, so breaking lines or columns requires special algorithms. In Japanese (with no spaces between words), line breaks are allowed anywhere within a word, but you must not split multicharacter symbols.

Word boundaries are often difficult to define. For example, both *Feueralarmschalter* in German and fire alarm switch in English are essentially compound nouns, but in English, there are spaces between each of the words.

Special typesetting styles (e.g., boldface, italic, and underlining) may not translate well to another writing system. Different cultures also have different conventions for expressing emphasis.

Developers should prepare for all kinds of sorting preferences and strategies. Even in the relatively "safe" realm of Roman scripts, there are variations. In

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Even this small sample shows the variety of ways numbers, dates, times, and currencies are represented in different countries.

English, sorting is from *A* to *Z*. In German, characters *with* an umlaut sort directly after the character without an umlaut; but in Swedish, *Ö* comes last in the alphabet. Spanish has double characters (e.g., *ll* and *ch*) that sort as single characters.

As any Westerner who has tried to look up an expression in a Chinese dictionary knows, sorting complex scripts is difficult. One criterion here is the radical (i.e., root) of the character, the number of basic strokes that is needed to create the character. In these multibyte scripts, multiple character patterns may stand for the same word and should thus sort together. This could require multilevel sort algorithms.

Editing Issues

These categorizations raise a number of issues about editing functions. For example, to convert between uppercase and lowercase, programmers familiar with the standard ASCII character set often add or subtract 32. (This constant is the difference between the numerical ASCII codes for *A* and *a*.) But even for the extended character set needed to represent Western European languages, this approach may not work. For example, the difference between *Ä* and *ä* may not be 32. The accent or umlaut may also have to disappear in uppercase.

The same challenges for sorting and capitalization apply to search algorithms. String searches must be capable of accepting different character sequences as equivalent. Wild-card characters that are used in Find dialog boxes may have a meaning in the target language and might therefore be unusable.

In a speed-search situation, where you type the first letters of a word, both accented and unaccented occurrences should appear. (If I type *a*, I expect to get words starting with *A*, *Ä*, *a*, *à*, and so forth.)

Hyphenation of long words at line breaks is not as easy in other languages as it seems in English. In German, characters in a word may have to change to hyphenate it. French sometimes requires a hyphen if two otherwise separate words extend beyond line's end.

Inflection Impact

English-speaking developers should keep in mind that other languages may have much more inflection (i.e., changes to words) depending on tense, case, and gender. While French and other Romance languages have two genders, German has three, and there is one language that has 17. This may, for example, influence the way you write ordinal numbers.

There is no magic bullet for dealing with the differences among languages. Awareness of the possibilities and flexibility in the code are the most important guidelines. You'll still get surprised occasionally, but not as often as if you just coded your program and dumped it into the Translate-O-Matic. **–U.F.**

Avoid the Global Faux Pas

Icons, metaphors, and symbols are some other important issues for developers who need to create software applications that are used internationally. Among the things to watch for are symbols or even colors that may be offensive in other cultures.

In addition, some icons are not easily recognizable across cultures. One example is a mail application with a mailbox icon that raises the red flag when mail has arrived. This type of mailbox is used only in the U.S.

While you must consider these issues carefully, the user interface should still use symbols as much as possible. Many international symbols are widely understood. In Europe, traffic signs are generally symbols with no text, because drivers who do not speak the language will have to understand them.

A design goal of icons is that they should contain no text, because it may not fit in the icon's space when it's translated. If an icon requires a textual explanation, it is better to use Mac-style Bubble Help.

There are a number of books available on this subject. A good one is *Global Interface Design* by Tony Fernandes (Academic Press, ISBN 0-12-253790-4). **–U.F.**

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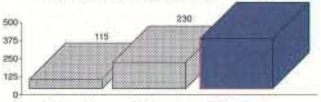

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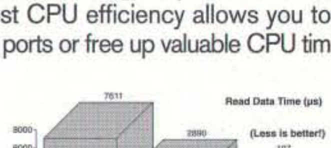

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Localization Help

The Localisation Industry Standards Association (LISA; http://www.lisa.unige.ch/) is a private, nonprofit association in Geneva, Switzerland. LISA cooperates with industry partners, providing support for software localization.

Componentized Unicode

Gamma UniVerse (from Gamma Productions, which is a developer of cross-platform foreign-language products that are based on the Unicode standard) is an ActiveX control that brings Unicode support for existing applications and OSes, potentially covering more than 175 languages. It enables developers to write and maintain global applications for the borderless world of the Internet/intranet.

Used as a stand-alone multilingual editor application for Windows or embedded in applications supporting any OS, Gamma UniVerse lets applications written in C++ or Visual Basic transparently support the Unicode character-encoding system. It is compatible with Microsoft's ActiveX cross-platform standards.

Browsers with an Accent

Accent Software International is one of the best-known players in the multilingual-software arena. Its Internet With an Accent is a multilingual Web viewer and publisher. It includes four components. First, a multilingual version of the Mosaic Web browser interprets a Web page's characters. Users select one of over 30 languages and character sets from a menu in the toolbar. A free Netscape plug-in is also available.

Second, a Hypertext Markup Language (HTML) editor takes the hassle out of writing multilingual Web pages. The third component is a viewer for documents created with Accent's word processor. Finally, it includes MailPad, a multilingual e-mail application.

Tango Browser, from Alis, also displays Web pages in dozens of languages. With Tango Browser, you can select its interface language, automatically retrieve pages in the language you prefer, and input text in a wide variety of languages. **–U.F.**

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http://unicode.inc@unicode.org

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(RESELLERS: 140)

Unicode Evolves

Worried about localization problems? Content-enabled software, through Unicode, may be what really matters. **By Ken Fowles**

Most computer users will tell you that a user interface localized into their language is certainly nice to have. However, a more urgent priority for most people is being able to create and retrieve content in their own language. In one way this need is a blessing: Instead of having to develop unique UIs to support roughly 250 widely used languages throughout the world, you can probably limit your development efforts to "only" 10 or 20 localized UIs to handle content.

On the other hand, building content-enabling applications for multiple languages is littered with development pitfalls. For example, you will run into the mathematical limitations of the 8-bit (that is, 256) character sets used in Western European languages. Western Latin character sets such as ISO 8859-1, IBM Code Page 437, or Windows ANSI 1252 won't even cover the requirements of the European Union since Greece is an EU member and Greek doesn't fit into those character sets. Add Turkey and Central and Eastern European countries and interoperating among the hundreds of possible 8-bit encodings becomes a nightmare.

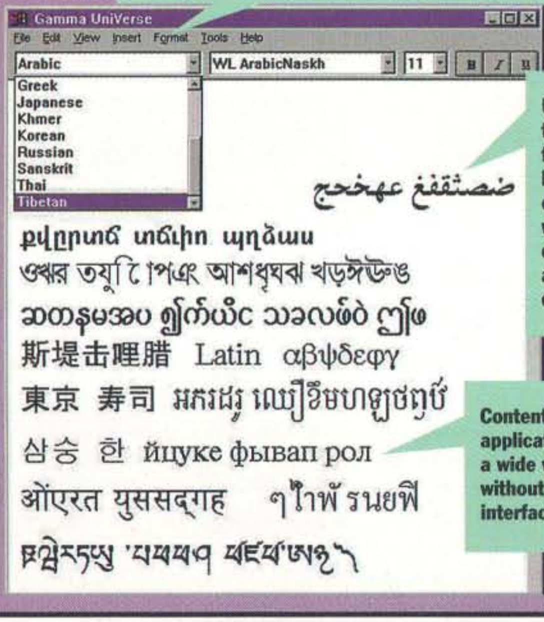
Then there are the CJK (Chinese, Japanese, Korean) languages, which require character sets with many thousands of characters. Japan is now the world's second largest user of software, and countries that require Chinese and Korean character sets have double-digit growth rates.

For years, Unicode, the standard for uniform 16-bit encoding of information for the world's commonly used scripts, has offered a way around these linguistic problems. Today, the growing internationalization of business is giving Unicode a higher profile than ever among software developers. Savvy developers also have learned ways to make working with Unicode as smooth as possible.

Unicode exists primarily because alternatives for internationalizing applications aren't foolproof. For example, various multibyte (double-byte character set, or DBCS) encodings exist and use a mix of 8- and 16-bit characters. But a variable-width encoding requires special leadbyte characters or escape sequences to identify the width of each character. Multibyte encodings lack the fixed-width simplicity of ASCII, as characters cannot be manipulated until they are individually inspected to determine their size. Moving a pointer backward through a multibyte string requires specific APIs or lengthy algorithms. If an application is targeting only one Asian country, for instance, then it's not really an international product, so multibyte encoding is good enough. But multibyte's separate requirements make it unattractive for truly international products.

Localize Content, Not the Interface

Localizing this application would require translating the entire user interface into the local language, often unnecessary with users who already know the UI, and requiring extra cost, time, and effort. Also, the application would handle content only in that one language.



Unicode provides the foundation symbols for a multitude of languages, including complex languages where the appearance of one part of a word affects the appearance of another.

Content-enabling the application allows it to handle a wide variety of languages, without altering the user interface.

Gamma's Unicode-based word processor can display many languages at once.

Unicode to the Rescue

The Unicode/ISO10646 standard provides one uniform 16-bit encoding that can store information from all the world's commonly used scripts. The key word here is "standard." Unicode itself is a standard, not a technology. Where technology gets involved is how the software makes use of the standard.

The Unicode concept of parking characters into a 64-KB space sounds simple enough—until you realize there are three or four times that many characters in the world's written languages. So a key part of Unicode's design is to handle that 64-KB space as valuable real estate since it has to support a large number of scripts in one consistent encoding.

Several parts of Unicode's design help it maximize this use of what's called a *codepoint*, the permanent Unicode address of each character. For example, diacritic marks in most other character sets are not stored as unique characters, but in Unicode each diacritic can be separately tracked and shared among several characters. Codepoints are conserved through Han Unification, sort of like a highway carpool lane where two or three characters with similar appearance share the same space. To Unicode, small differences in appearance should be handled as a font issue, not by inventing another character encoding. Also, Unicode does not guarantee a particular sort order, since software should handle that separately.

Unicode Assumptions

Certain specific assumptions, to maximize its utility, underlie the Unicode standard:

Permanent assignment. The number of assigned characters has grown to a total of 38,885 in Unicode 2.0, but by design no Unicode character has become obsolete. The Unicode Consortium is allocating additional space carefully, so existing assignments can be permanently relied on.

Fixed-width, 16-bit encoding. Much like ASCII, Unicode characters are always the same size. Nulls are 16-bit.

No escape sequences. Since Unicode is fixed-width, there is no need for leadbyte or other noncharacter ranges.

Diacritics and base characters. Any diacritic or accent mark can combine with any base character at run time, which saves encoding space. For compatibility, there are also some equivalent assignments of precomposed character combinations.

Plain text. Unicode codepoints have no inherent meaning; they represent plain text independent of language.

Logical order. Unicode is stored and retrieved in logical order, which is not necessarily the same as visual order.

Private use area. Instead of cloning new character sets for custom requirements, Unicode has a preassigned area where you can add special end-user characters.

On the flip side, there are certain aspects that are specifically *not* a part of the Unicode standard, including:

System Support for Unicode

Apple Macintosh
- System utility can convert data to and from Unicode.
- QuickDraw GX allows direct Unicode codepoint input.
- TrueType glyph indices use Unicode.

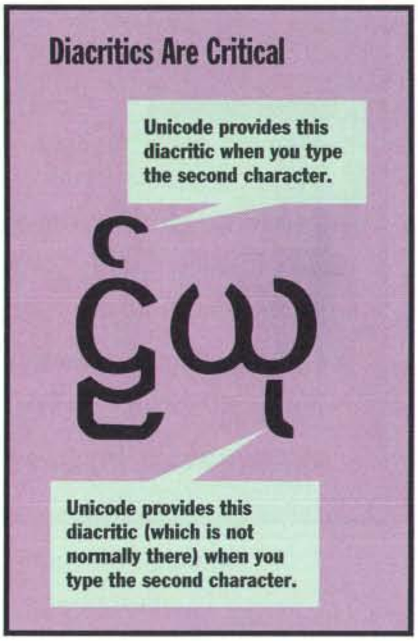
Microsoft Windows 3.x
- None, but can convert data to/from Unicode through Win32s.

Windows 95
- API converts data to/from Unicode.
- TrueType glyph indices use Unicode.
- Display-side APIs are available in Unicode.

Windows NT
- Operating system internally assumes Unicode, automatically converts from individual charsets if necessary.
- All text I/O APIs can be set to Unicode.
- TrueType glyph indices use Unicode.
- NT 4.0 added UTF-8 data conversion.

Unix
- Comprehensive support in Plan 9 from AT&T, but majority of Unix variants have little or no direct Unicode support.

Java
- Java is the first programming language to define Unicode as its default data type. However, as a programming language, it has no display rendering or other mechanisms that are the responsibility of the host system.


Diacritics Are Critical
Unicode provides this diacritic when you type the second character.
Unicode provides this diacritic (which is not normally there) when you type the second character.

Unicode works in context. In Burmese, for example, it adds diacritic marks.

Rendering and display. The Unicode range includes complex languages (Bengali, Devanagari, etc.); however, none of today's OSes can automatically render the entire range of Unicode characters. Remember, the Unicode standard is a means of character encoding, not a development library or technology.

Typographical issues. The specific appearance of a font is an artistic issue, whereas Unicode itself provides only plain text. A glyph that "looks wrong" for a particular language can be remedied by changing the typeface instead of requiring a new character set. There are fonts that map a wide range of Unicode characters, but there's no single consistent "Unicode font" that looks perfect in all the world's languages because visual adjustments must be made for some languages. Unicode is a single encoding that may require multiple typefaces.

Sort order. Most modern OSes and database platforms can sort or compare characters and strings. Unicode does not guarantee a particular sort order.

Character input. Keyboard layouts and input methods are dependent on software, not on character encoding.

Locale-specific data. Currency symbols and punctuation marks are not assigned to any particular locale in Unicode. The Unicode specification does not contain locale formatting information such as date and time conventions.

Unicode Tools for Developers

Once you understand what Unicode does and does not provide, the next step is to find reasonable development shortcuts offered by OSes and tools. It is entirely possible to write a fully Unicode-enabled application without any system-level support or specific tools, but there are obvious advantages to using built-in support.

If the thought of using a fixed-width 16-bit encoding seems like a waste of file space or download time, remember that the alternatives can be much worse. A bit map

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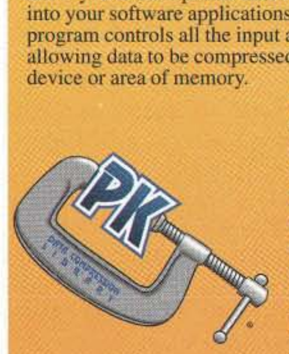

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of text takes far more space than any character encoding, and a bit map loses all meaning—you can't search or sort on it. If you're using bit maps to store international text, you have effectively created a very expensive fax machine.

Although Unicode has rapidly gained popularity, several generations of OSes and tools were around long before Unicode existed (work on Unicode began in 1988, and the Unicode Consortium formed in 1991). The easiest way to support Unicode is when the operating system provides full support in every text I/O function. It is much more difficult to retrofit an operating system for Unicode than an application, and the most popular development tools don't mask the system's shortcomings in this area.

Does Your Browser Support Unicode?

None of today's mainstream Web browsers fully supports Unicode I/O, but they are able to use Unicode at least for display purposes. Does this mean they require the use of special Unicode Web pages? No. In this case, Unicode is used as a conversion and display mechanism, so the same product binary can display text in more languages. Once a Hypertext Markup Language (HTML) page's character set is identified, the browser converts it to Unicode and sends wide text directly to the operating system.

Microsoft Internet Explorer 3.x

IE3 can display (but not input) a wide range of noncomplex Unicode languages, using system National Language Support (NLS) tables, system TextOut support, and additional font packs (which can be downloaded at http://www.microsoft.com/ie).

Netscape Navigator 3.x

On Win32 platforms, Netscape can be set up to use Unicode display (but not input) by editing the registry entry for HKEY_CURRENT_USER\SOFTWARE\NETSCAPE\NETSCAPE_NAVIGATOR_INTL. Enter "UseUnicodeFont" for value name field, enter "1" for string field, and then pick an appropriate TrueType Unicode font mapped to Unicode (such as Lucida Sans Unicode).

Spyglass Mosaic

Spyglass acquired some Unicode expertise from Stonehand, an early supporter of Unicode. Also, Accent Software and Alis have added Unicode support to Mosaic.

Use Where Needed

Fortunately, Unicode is not a monolithic yes/no issue for an entire product. So you might use Unicode in some areas where it's to your advantage and rely on individual character sets in other areas. Consider an incremental approach.

Here are some implementation priorities to think about when contemplating tools or operating systems.

First is the ability to convert existing data to and from Unicode. This is Unicode at its most basic level, and it's very easy to implement. Many of today's OSes provide APIs, utilities, or sample code for this. The advantage is that Unicode makes a great central conversion point since it's a superset of many common character sets.

An example is a client/server database, where the server stores data in Unicode and each client assumes a single character set. There are some cases where a 100 percent round-trip mapping to/from Unicode is not possible, mainly with Asian multibyte encodings. But the lost characters are generally those that are unique to a proprietary character set and cannot map to any other character set. If your target OS or tools fail to provide character-set conversion, you can build your own conversion using mapping tables available from the Unicode Consortium.

Also consider character display from within a document. "Document" is not just for word processing; it can refer to any application that handles data. Although Unicode does not provide a display rendering engine, using a consistent encoding helps in the development of products that can display documents in a large number of languages from the same binary. An OS that is not fully Unicode-enabled may support Unicode content display—an important shortcut if you want to consolidate your international binaries. Text display is easier to implement than text input, and it is often a higher priority. (If you have any doubts about that, think of all those Web browsers out there.)

Next, remember that you can categorize character display into "simple" and "complex" languages. Although it contains many characters, Japanese is a "simple" language to display because its characters are static and do not change shape. Arabic, Hindi, and Tibetan are examples of complex languages because a character can dynamically change shape as you type other adjacent characters or diacritics. Today's OSes can display most simple languages but very few or none of the complex languages. If you require complex languages, you may need to use an OS add-in unless you want to write a huge amount of code from scratch.

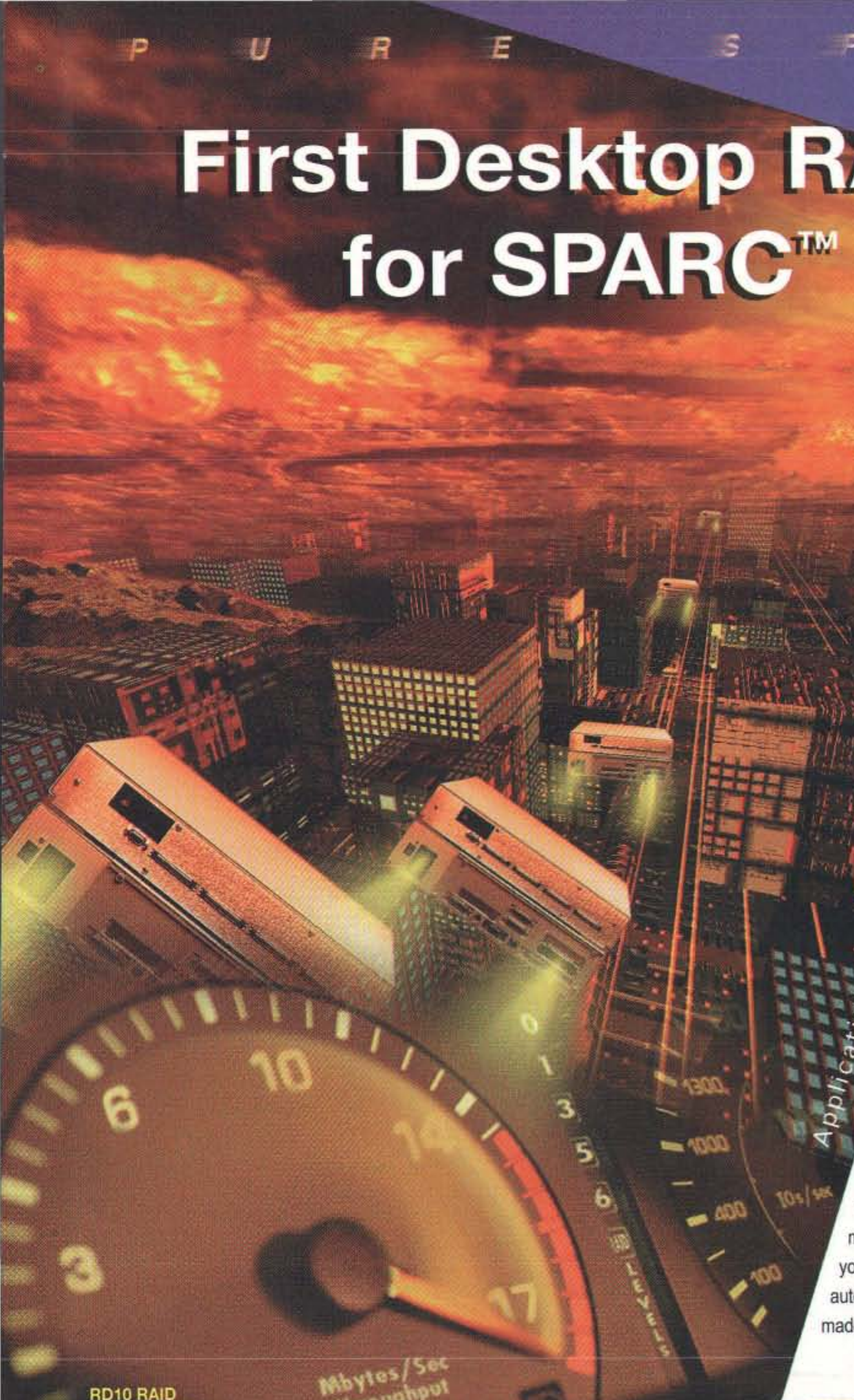
Another consideration is character input into a document. If the target system accepts Unicode at the input side, you can avoid having to `#ifdef` for DBCS at every edit field. Cursor movement, text selection, copying, insertion, and pointer math are directly dependent upon how consistent or inconsistent your encoding is. As of today, few OSes automatically handle Unicode at the input side, so you may want to use third-party libraries or tools for Unicode-enabling from companies like Gamma Productions (for whom this author works), Star+Globe, and Zinc. Keep in mind that character encoding cannot solve certain internationalization requirements such as Asian input methods or switchable keyboard layouts.

User interface issues include menus, list boxes, and dialog boxes. Being able to directly send Unicode to a system UI is convenient, but it's not offered in most systems. Unless you are building a multilingual UI that can be switched at run time, you will be shipping separate binaries for the UI portion of your application, even if you have full Unicode document content I/O. UI localization methods are a separate topic from international content enabling, although they will feel the Unicode impact more in the future as tools continue to improve.

Developments such as Java indicate that we can someday expect dynamic support for the UI in any language, just as today it has become easier to dynamically support document content in a wide number of languages from within a single application.

Unicode Tips

Although every software development project for international use differs, here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are some general suggestions you should follow as you tread the Unicode path:

First, read the book. The Unicode standard was recently updated. Not just for inducing sleep anymore, the v2.0 book is much larger and is more than just a bunch of tables. It includes technical descriptions of the world's major language scripts, material on composition of complex writing systems, sample code for UTF-7 and UTF-8, and other goodies that international software designers will find useful.

Always manipulate characters, not individual bytes. You do not, for example, want to accidentally grab half a Unicode character during pointer movement.

Change any code that assumes that characters are 8 bits long. Also, check for references to any index of size 256, a potentially incorrect assumption about characters being only 1-byte long.

Remember: Even though it's a waste, a Unicode null = 16 bits.

Compilers are not always closely connected to the target operating system. Parameters for wide-character support may step into thin air, even if your compiler comes from the same company that built the OS—best to check with the system's API reference before making assumptions.

The ANSI/ISO C standard includes the Wide Char data type, `wchar_t*`. In some cases you can use `wchar_t*` instead of `char*` to return 16-bit characters instead of single bytes. But you have to be careful: On many Unix implementations, `wchar_t` returns an 8-bit value.

Lastly, use an incremental approach. Don't become discouraged by the lack of Unicode support in some operating systems; they often support at least some Unicode shortcuts, which you can use now and expand upon later. Or get some libraries and tools that help you work around these issues independently of the OS for now. They'll catch up to your farsightedness eventually. B

*Ken Fowles (**ken@fowles.com**) works for Gamma Productions, Inc. (San Diego, California; **http://www.gammapro.com**), which builds Unicode-based software.*

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The Unicode Consortium
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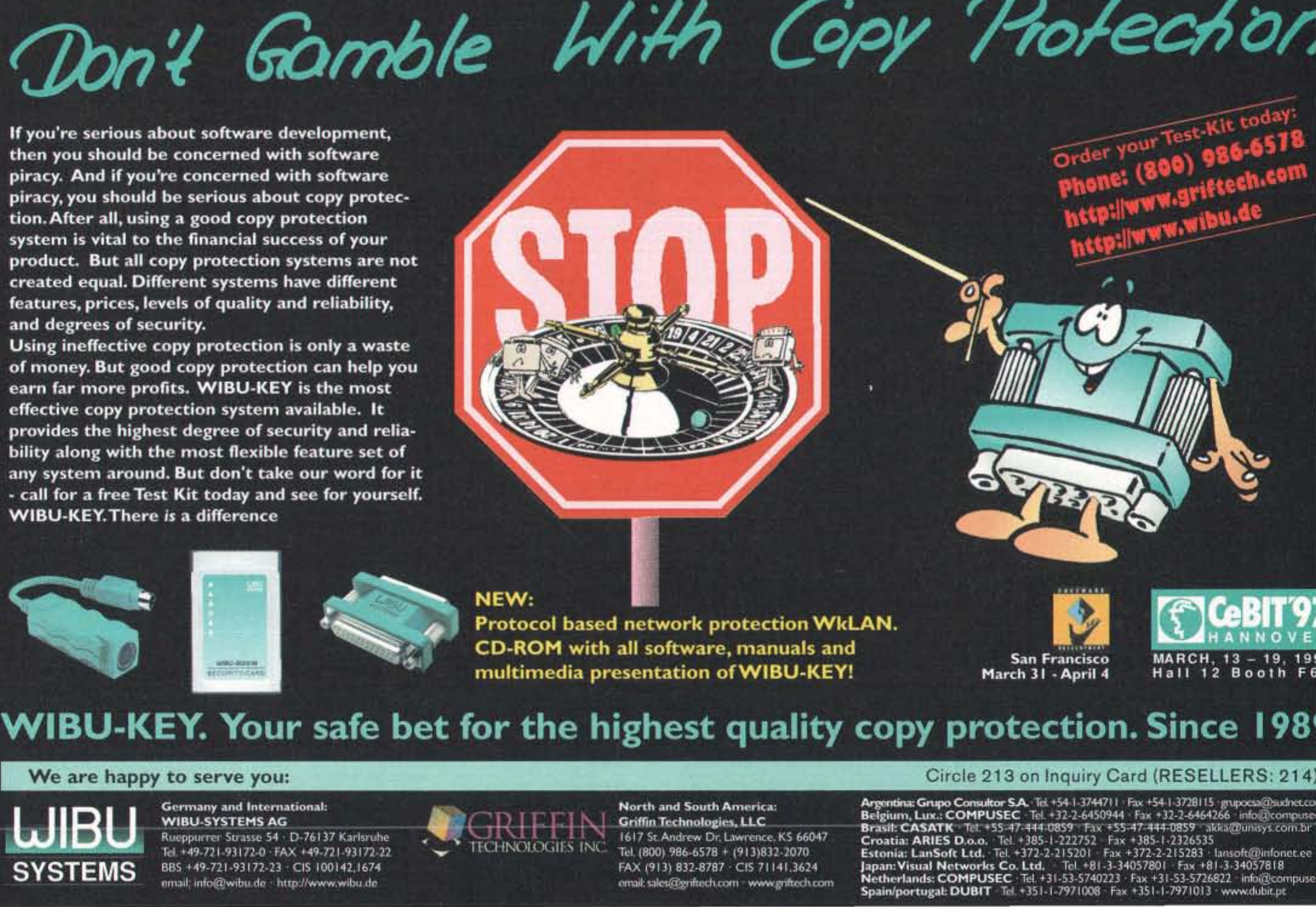
http://www.unicode.org



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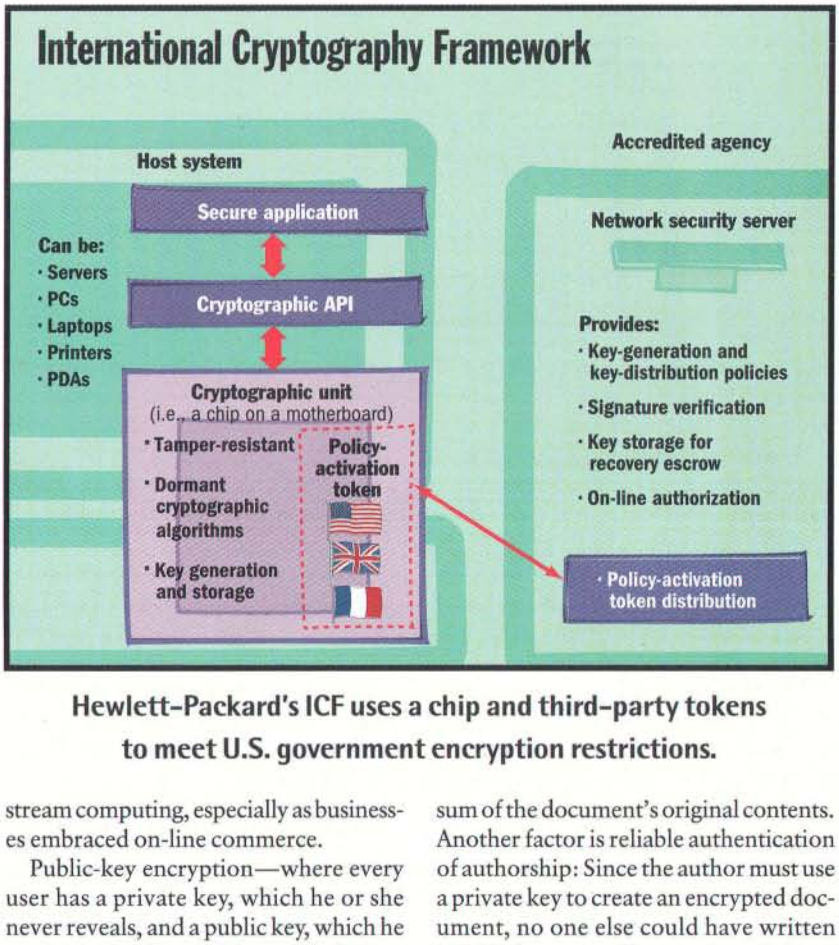
Encryption for a Small Planet

How developers can cope with U.S. export restrictions on encryption technology. ***By Thom Stark***



Hewlett-Packard's ICF uses a chip and third-party tokens to meet U.S. government encryption restrictions.

In January 1996, Qualcomm, a networking and communications company, needed to secure a virtual private network that passed from its San Diego headquarters through the Internet to a branch office in Singapore. The best way to accomplish this was to use 56-bit triple DES, a version of an encryption standard that dates back to the mid-1970s.

This presented a problem, however: Under U.S. law, Qualcomm needed State Department permission to deploy the technology overseas. Qualcomm sought exemption from the U.S. government's export restrictions on encryption technology because the branch office was staffed exclusively by U.S. citizens. The request was denied.

Today, U.S. law still prohibits such a request. In fact, export restrictions put many software developers in the frustrating position of not having access to the security technology they need to run applications in a global marketplace.

More than ever, today's applications, including on-line commerce, require data confidentiality, authentication, and repudiation capabilities, all of which are available from existing cryptography technologies. Unfortunately, the governments of the U.S. and other countries are firmly opposed to the use of strong cryptography in products designed for the international market.

These restrictions are the subject of intense debate in political and computer communities alike. But if you develop software that can run on desktops worldwide, you can't wait for the debate to end. You have to find a way of dealing with export restrictions now.

Modern Cryptography

The Internet is partly to blame for this cryptography confusion. As the Net metamorphosed from an academic test-bed to a global information infrastructure, digital cryptography emerged from the intelligence-community closet into mainstream computing, especially as businesses embraced on-line commerce.

Public-key encryption—where every user has a private key, which he or she never reveals, and a public key, which he or she can freely reveal—is often the best answer for secure on-line commerce. In the public-key model, outsiders cannot decrypt any data that's been encrypted using only a private key, unless they break the encryption or the private key is compromised. To enable select recipients to decrypt data, the author encrypts the data using his or her private key and the recipients' public keys. Those parties whose public keys were used to encrypt the data can then use their respective private keys to decrypt it; they use the author's public key to establish its authenticity.

One factor that makes public-key technology attractive is *digital signatures*, where an author uses a private key to produce a signature block based on a checksum of the document's original contents. Another factor is reliable authentication of authorship: Since the author must use a private key to create an encrypted document, no one else could have written it. Third, you can disavow forged documents: No one can forge a digital signature with a user's public key. Likewise, public-key users can "countersign" each other's public keys, thus vouching for each other. All these factors help make on-line transactions more secure.

Alternatives to public-key encryption include the aforementioned DES, a 56-bit-key-length method that uses a symmetric, or *shared-secret*, encryption scheme where trusted parties have access to a given set of encrypted data and an identical key. A shared-secret scheme permits faster decryption than is possible with public-key technologies, but if any shared-secret key is compromised, all the keys are compromised. In addition, there's no

More Bits, More Security

Here are the theoretical times needed to crack keys of different lengths produced for DES encryption. Note that 56-bit keys are the typical size for export under current U.S. law.

40-bit DES: a maximum of approximately 0.4 second
56-bit DES: a maximum of 7 hours
64-bit DES: a maximum of 74 hours, 40 minutes
128-bit DES: a maximum of 157,129,203,952,300,000 years

In the real world, a graduate student's network of Unix-based computers cracked Netscape's 40-bit encryption in eight days (and would have taken a maximum of only 15 days, even if it had had to try every single key). Keeping in mind that Netscape does not use DES (it uses RC-4, an alternative cryptographic system), that matrix would look like this:

40-bit: 15 days maximum
56-bit: 2,691.49 years maximum
64-bit: 689,021.57 years maximum
128-bit: 12,710,204,652,610,000,000,000,000 years maximum

way to determine who created any given data item, since any of the common keyholders could have encrypted it.

The reverse is also true. Any particular keyholder cannot conclusively disavow authorship of data encrypted with a shared key, so a third party can forge data using the shared key. This is especially true if that key is compromised without the knowledge of the authorized keyholders.

Token Security

Despite its strengths, public-key encryption isn't foolproof. It works best when the users all know each other or when they countersign each other's public keys, which effectively authenticates the keys. But in most global transactions, the principals don't know each other personally. Therefore, in a global public-key environment, a less cumbersome (and more secure) mechanism is necessary.

This has led to the appearance of commercial middle-layer companies, such as VeriSign, which are known as *certificate authorities* and act as trusted third parties. Their role is much like that of a bank that effectively turns your personal checks into currency. A certificate authority countersigns public keys with its own private key and makes both the user's countersigned public key and its own public key available to the general public through a well-known and secured HTTP or FTP server. Other users can download the certificate authority's public key to verify countersigned keys belonging to persons or organizations they do not personally know.

This isn't the only situation where third parties get into the global-transaction act. Another way to deal with password problems is through the use of tokens, which are generated automatically by either the encryption hardware or software or, in the key-recovery model discussed earlier, issued by a trusted third party. Tokens usually reside on a local disk and can, therefore, be portable. Tokenized encryption schemes simply substitute the contents of a token for the password that a more interactive encryption system requires. You can use tokens in either public- or symmetric-key encryption.

Developer Dilemmas

Since the encryption strength for any given algorithm is roughly 2 to the power of the key length, encryption using 56-bit keys is about 65,536 times stronger than the same algorithm using 40-bit keys.

But there are several burdens on developers seeking a simple solution to developing products for the global market. First, there's no provision for permitting the export of existing 56-bit cryptography products after December 31, 1998. Given the often-chaotic nature of product-release cycles, this could easily leave software developers unable to offer support, patches, or in-line upgrades for foreign clients who purchase 56-bit products and are unwilling or unable to upgrade to a version that supports key recovery.

Second, software developers must present a plan and a time line for implementing key recovery. That can be a tough task. A developer's customers might not be willing to sign up for key recovery as a condition of purchase for future products. Besides, foreign governments are unlikely to permit the U.S. government to access the keys of foreign companies or individuals.

Third, with the addition of the Justice Department to the Export Administration Review Board membership, two-thirds of its members represent defense, intelligence, or law-enforcement constituencies, all of which have an interest in limiting the spread of strong encryption. This potentially hampers developers wishing to market products with strong encryption.

Loopholes and Strategies

U.S. software vendors have taken a number of approaches to the export dilemma. Some have simply created versions of their products that employ strong encryption for the domestic market and weak, 40-bit versions for their foreign customers. Netscape is perhaps the best-known company to adopt this strategy.

Is 40 bits good enough? Since Netscape's Navigator and Commerce Server are widely deployed in Internet-based commerce, their products were among the first targets of public code-breaking efforts. On August 16, 1995, French graduate student Damien Doligez announced that he had broken Navigator's 40-bit SSL (Secure Sockets Layer) encryption in only eight days by using 120 networked Unix machines to test possible keys one by one (see the table "More Bits, More Security" above). If he had had to try every key, the process would have taken a maximum of 15 days.

Lotus Notes employs a different workaround. Charlie Kaufman, the security architect for Notes 4.0, explains that the software uses a technique called Differential Workfactor Cryptography to permit its international version to comply with U.S. export restrictions. "When a bulk data key is created, a 64-bit random number is generated," he explains. "In the international version of Notes, 24 of the bits are encrypted under a public RSA key provided to us by the U.S. government. The result—called a Workfactor Reduction Field—is bound into the encrypted data. There's no Workfactor Reduction Field in the North American edition of Notes."

Kaufman cautions that although 64-bit encryption can protect us from students like Doligez for quite some time to come, "there's no question that people who are willing to build custom hardware for

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- Loop back Test with 511 and U test pattern. Power-on self test.
- Auto-or Manual-retain with full forward/fall back rate negotiation
- Storage: Max.4 telephone numbers and 2 user profiles (Expandable)

- PSTN or 2/4 wire leased line with dial back up.
- Power-on auto dial-up with auto re-dial, leased-line auto connection
- Auto dial/answer, Manual dial/answer. Synchronous/Asynchronous, AutoSync.
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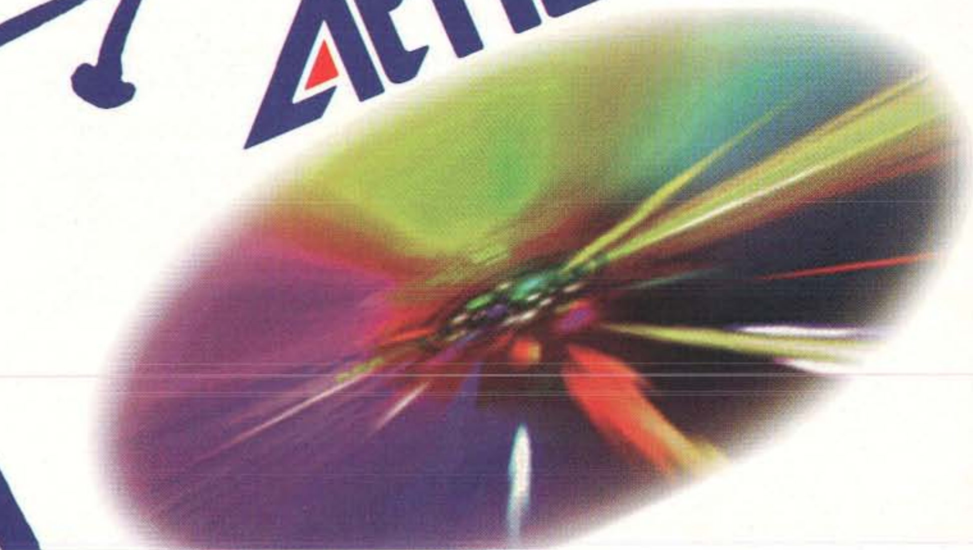

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cracking engines could break 64-bit encryption today, at a reasonable cost."

Sun Microsystems takes yet another route. It exports its Solaris OS with support for secure remote procedure calls (RPCs); this requires both DES encryption and the Diffie-Hellman key-exchange mechanism. (The latter is a method for two entities to interactively create their own encryption key for one-time use.) Sun avoids conflict with export laws by leaving the DES and Diffie-Hellman libraries out of the shipping product and requiring users wishing to use secure RPCs to buy a separate kit that includes these libraries.

Qualcomm uses a different strategy in the current version of Eudora, its ubiquitous freeware and commercial e-mail client. The company has adopted a plug-in architecture to permit third parties to add modular functionality to Eudora 3.0; it has also published an open API to which third parties can write their plug-in.

Phil Zimmerman's new company, PGP, Inc., has chosen to publish its own API to allow third parties to integrate PGP encryption into their own products. In the meantime, PGP is producing 40-bit exportable and 128-bit domestic versions of its Viacrypt commercial PGP product line. PGP is also producing a PGP plug-in for Qualcomm's Eudora.

Meanwhile, Hewlett-Packard has announced what it calls the International Cryptography Framework. The ICF complies with the terms of the Clinton administration's executive order by proposing that an HP-made hardware-based encryption engine be incorporated into every PC, network computer, workstation, minicomputer, and mainframe.

The encryption capabilities of such a tamper-resistant chip would be activated by a software- or hardware-generated Policy Activation Token, which a network-security server controlled by a third-party "accredited agency" would issue. The chip, which HP has not yet made, would support Trusted Information Systems' RecoverKey technology, enabling government agencies, including foreign ones, to "recover" a Policy Activation Token without alerting the chip's user to that fact.

Strategies and Loopholes

Encryption strategy	Technology	Who's using it	Consequences
40-bit foreign; strong domestic	Limited to 40 bits	Netscape, PGP	Different products; uncompetitive abroad
56-bit foreign	56 bits; U.S. government control	Eleven-company group	Might loosen encryption restrictions
64-bit foreign and domestic	24 bits; encrypted by U.S. government	Lotus (in Notes)	Depends on U.S. government cooperation
Optional strong foreign encryption	Separate kit with DES and Diffie-Hellman libraries	Sun Microsystems (in Solaris)	Foreign users must buy extra components
Optional foreign encryption	Optional plug-in modules to open API	Qualcomm, PGP	Foreign users must buy extra components

HP has announced that Intel will manufacture the ICF encryption chip for HP server, workstation, and midrange computers beginning this year. However, the proposed chip will support only 56-bit DES encryption, which may be too weak to offer reliable data integrity after 1998, when the current statutes expire. Also, the tamper-resistant design of the sealed unit can be an opportunity for the U.S. government to arrange for a "back door" into the chip, without any user being able to close that door. Developers might be reluctant to use a so-called spy on the motherboard.

Jim Bidzos says that RSA Japan, a subsidiary of RSA Data Security, has agreed to permit Nippon Telephone and Telegraph (NTT) to develop and market an encryption chip that will use 1024-bit RSA public-key technology for authentication and digital signatures, as well as 128-bit conventional cryptography for bulk encryption. But U.S. companies that incorporate the RSA/NTT chip into their products still cannot reexport those products.

Alternatives for Developers

At present, there are no easy answers to the encryption conundrum. Software developers who wish to incorporate cryptographic technology into their products have only three choices. They can continue to produce 40-bit exportable versions and watch their foreign market share diminish; they can produce 56-bit export versions and sign up for a problematic key-recovery scheme; or they can simply wait for further developments to occur and, in the meantime, concentrate on lobbying Congress and the Clinton administration to further loosen current export controls.

None of these alternatives is attractive. Moreover, the race to dominate an emerging global on-line marketplace adds increasing urgency to the need to find a solution that protects everyone's interests.

But there is good news—as the Computer Science and Telecommunications Board (CSTB) of the National Research Council (NRC) concluded in its report on cryptography's role in securing the information society. "Widespread commercial and private use of cryptography in the U.S. and abroad is inevitable in the long run," the report says. "Its advantages, on balance, outweigh its disadvantages."

Thom Stark is president of Stark Realities, a LAN/WAN/Internet consulting firm based in the San Francisco area. You can reach him at **thomst@netcom.com.**

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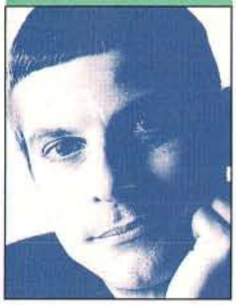


Digital IDs

Server and client certificates aren't yet widely used for authentication, but that's changing fast. Here's a progress report.

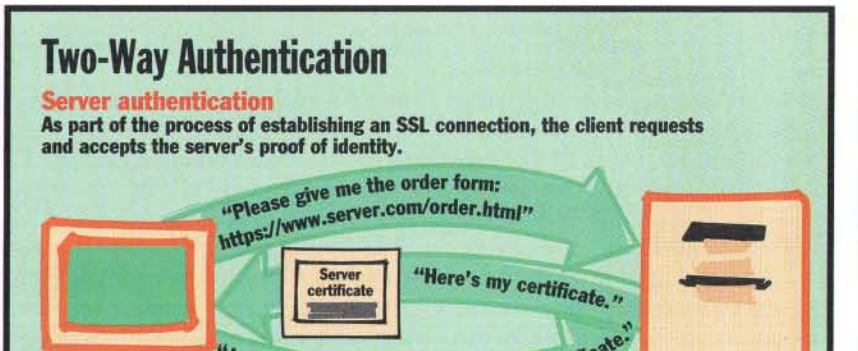
At an Internet conference in 1995, Netscape cofounder Jim Clark said he had concluded that government control of cryptographic keys was inevitable, so we might as well get used to the idea. "Why are you advocating a hierarchical, patriarchal model?," an irate listener jumped up and shouted, adding that it would violate everything the Internet has taught us about building cooperative systems. "Because it's what I think," said Clark.

Today, however, Netscape finds itself at the forefront of a movement to create a secure Internet that looks much less like the world of Big Brother and much more like the loose federation of systems that the Internet has always been.

As electronic credentials begin to replace plastic ones, it's likely (and desirable) that you'll continue to use many pieces of identification issued by many autonomous authorities. Besides credentials from banks, schools, and libraries, you'll hold credentials from other kinds of certifying authorities, including, perhaps, BYTE.

I'm confident that digital IDs will be the right way to regulate access to subscriber-only areas of the BYTE Site. To that end, I'm experimenting with three uses of digital IDs—to secure a Web server, to authenticate Web clients, and to sign and encrypt e-mail.

When these elements come together smoothly, they'll deliver significant long-term gains, but until then, they'll cause a lot of short-term pain. Discomfort is inevitable because the technologies for electronic privacy are logistically daunting. Before we can routinely apply them, we must learn more than many of us wanted to know about the hitherto esoteric realm of public-key cryptography.



Two-Way Authentication

Server authentication

As part of the process of establishing an SSL connection, the client requests and accepts the server's proof of identity.

"Please give me the order form: https://www.server.com/order.html"
Server certificate
"Here's my certificate."
"I trust the authority that signed that certificate."
Browser
Order Form
"Here's the order form. By the way, this channel is now SSL-secured."
Web server

Client authentication

In the context of an SSL connection, the server can in turn request the client's proof of identity.

"Please give me the file: https://www.server.com/protected.html."
"It's protected. Let me see your ID."
"Here's my certificate."
Client certificate
Browser
"OK, I recognize you. Here's your file."
Web server

Server authentication happens routinely, but client authentication is a new frontier.

To establish Secure Sockets Layer (SSL) sessions with browsers, a Web server needs to hold a kind of digital ID called a server certificate. Why? Two reasons.

First, the certificate has the public key that the browser fetches so it can encrypt messages it sends back to the server. (One of those messages, sent as part of the initial SSL handshake, is the session key that the server can use to encrypt its traffic with the browser.) Second, the certificate

PHOTOGRAPH: KELLIE WALSH © 1997

carries a signature that binds the server's public key to an identity. In BYTE's case, for example, VeriSign's signature on our digital ID means VeriSign (http://www.verisign.com/) promises that the server presenting that ID really represents BYTE. For a year's worth of this assurance of authenticity, backed by a paper trail, we paid VeriSign $290.

Reading a Client Certificate with Sioux

Python code lists the values of Sioux's CGI variables, including the fields of client and certificates:

```
vars = os.environ.keys()
vars.sort()
for env in vars:
print '\t<LI> <B>' + env + '</B>: ' + os.environ[env]
```

Here's an excerpt from the resulting HTML page:

```
SERVER_PORT              443
SERVER_SOFTWARE          Sioux/1.0.1server
SSL_CIPHER                EXP-RC4-MD5
SSL_CLIENT_C              US
SSL_CLIENT_CERTIFICATE   d5d4795a.0
SSL_CLIENT_CERT_END      970116032800Z
```

Last summer, when I bought that certificate, VeriSign's fulfillment operation was in a state of disarray quite at odds with its commanding ownership of the fledgling certificate-authority (CA) industry. What should have taken only two weeks stretched to over two months, as VeriSign scrambled behind the scenes with a short staff and antiquated equipment.

That's all fixed now, and it's a good thing for VeriSign because the list of CAs that's preloaded in Navigator and Internet Explorer has gotten much longer recently. No matter which CA you choose, the procedure to acquire a certificate will work roughly this way:

1. Generate a key pair. Web servers that support SSL come with a tool for this purpose. For our Microsoft Internet Information Server (IIS) 1.0, it was:

```
c:> keygen password keyfile
requestfile CN=www.byte.com,
O=BYTE, L="Peterborough"
```

This created a file containing a private key, and a request to sign the corresponding public key and thereby bind it to the identity expressed in X.500-speak.

2. Do the paperwork. For our certificate, that meant a letter from a Webmaster (me) signed by a boss (editor in chief Mark Schlack).

3. Send the request file by e-mail or Web form, snail-mail the paperwork, send a credit-card number through one of these channels, and wait.

4. Receive the signed certificate and install it. Now you can turn on SSL, point a browser at an https:// uniform resource locator (URL) on your server, and establish a secure connection.

Hassle-Free Certificates

For real electronic commerce, there's no way to shortcut this procedure, nor would you want to. The value of the certificate you're buying depends on nothing but the reputed diligence of its signer. However, for development and testing, you can grab any old certificate and be off and running with SSL.

The first quick fix I found was Sioux. It's an Apache-derived Web server that uses Eric Young's SSLeay (pronounced "slee"), a freely available implementation of SSL. Sioux comes with a demonstration key and certificate, and it starts right up in secure mode.

Another source of instant gratification is http://www.xcert.com/. At Xcert Software's site, you can try out the things that CAs do. You can generate your own CA certificate, use it to stamp out your own "brand" of server and client credentials, and even manage the database of certificates that you issue. I used server certificates I created here to activate SSL on several test servers and my client certificates to test how these servers can in turn authenticate clients. A kit of CA tools will be included with the certificate servers forthcoming from Netscape, Microsoft, and others. Thanks to Xcert's early public demonstration, however, developers haven't had to wait.

Reciprocal Authentication

Since the advent of Netscape Navigator 1.0 and Commerce Server 1.0, the Web has supported one-way authentication. If you connect securely to the BYTE Site, you implicitly accept that it represents who VeriSign says it does. (In fact, you can't connect securely to the BYTE Site yet, for bureaucratic rather than technical reasons.) However, there is no reciprocity in the basic SSL handshake. The server gets no assurance that the client is who he or she purports to be. Client certificates provide that reciprocal assurance.

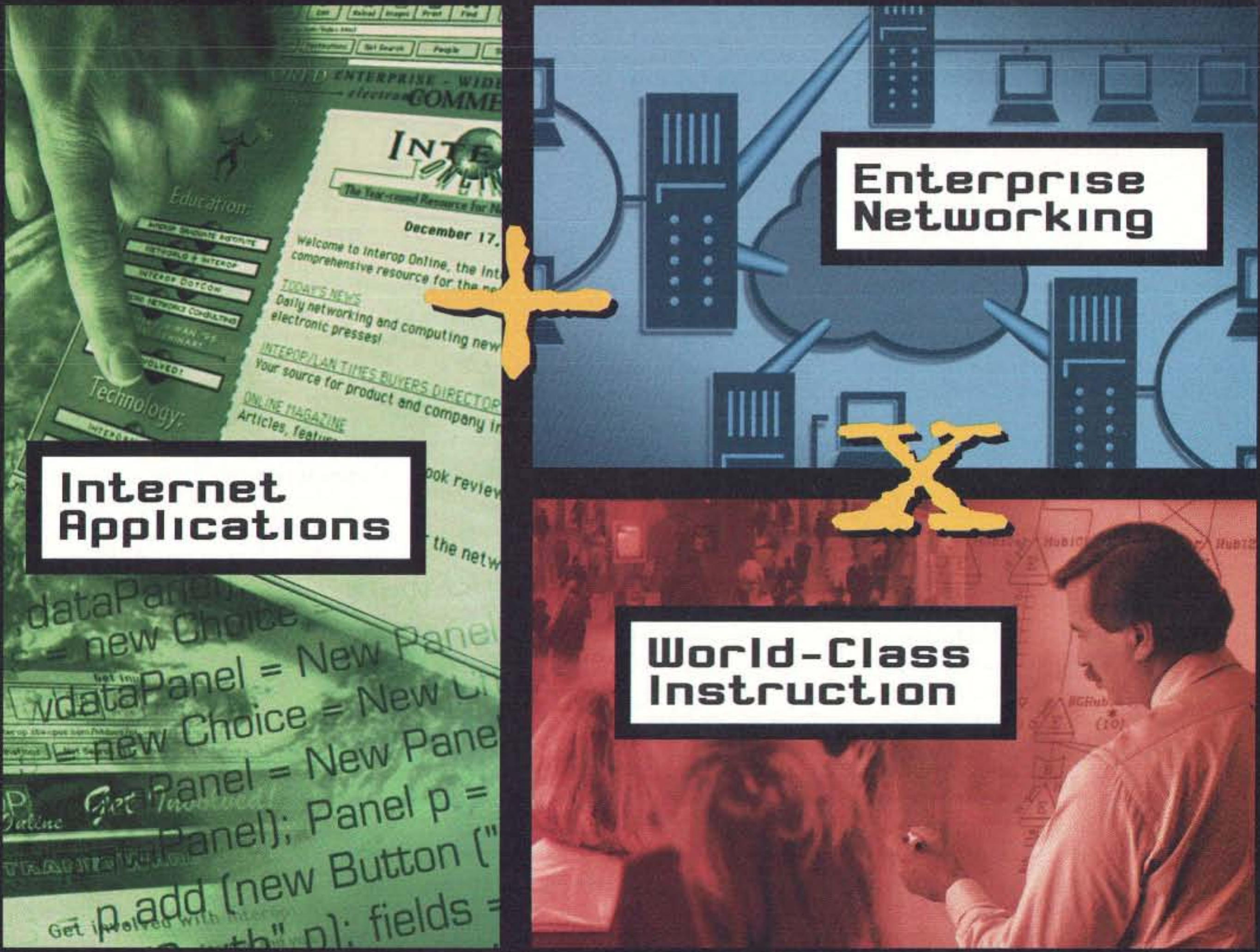
Why might the BYTE Site need to require that users present digital IDs? In commercial transactions, we'd like to know that you're entitled to use the credit-card number you give us. In public discussions, we'd like some protection against libelous statements made under forged identities. That scenario became real to me when DejaNews had to shut down the part of its service that enabled posting to Usenet. It's back now, but it's more cumbersome because DejaNews has to route each posting through its From: address. Digital IDs will probably supplant that mechanism.

From Cookies to Certs

Even though one-way authentication has been around for several years, it's less widespread than you might think. Using Netcraft's measurement technology (http://www.netcraft.co.uk/), O'Reilly and Associates polled 648,613 Web servers. Only about 10 percent responded in secure mode. "Among these," said the O'Reilly/Netcraft report, "only 3239 [about 0.5 percent] offered a valid certificate signed by a trusted third party."

Reciprocal authentication is even rarer because services that issue client certificates, and servers that know how to ask clients to authenticate themselves using certificates, are just now coming on-line. Today, a site that issues you access credentials likely does so by means of a cookie—that is, a name/value pair sent from a Web server to your browser and stored in a file on your PC.

What's wrong with cookies? They can't guarantee either privacy or authentication. Say the BYTE Site issues Joe Smith an access cookie of the form: name=BYTE,



Do the math.

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user=Joe Smith/35428. Clearly, the idea here is that the site will check the value of the BYTE cookie in transactions with its users. But any other Web server to which Joe connects can also ask for his BYTE cookie! If Joe stores private data on our site, it won't be hard for others to find it. Also, we can't prove that statements made in Joe's name—for example, newsgroup postings—are attributable to Joe.

Digital IDs can improve matters considerably. One approach would be to issue certificates ourselves. For a target group of subscribers, a registration procedure might ask for your subscriber number and use it as proof of identity. Another approach would be to outsource the CA function to a service that would issue and manage "BYTE-brand" certificates.

Sioux Authentication

I installed Sioux on BYTE's Linux server, fired it up, and was immediately able to establish an SSL connection thanks to its built-in demonstration certificate. At startup, though, the `SSL_ClientAuth` directive in Sioux's `ssl.conf` file is turned off, and Sioux does not require clients to present certificates. When I turned `SSL_ClientAuth` on, Sioux did ask for a digital ID. However, it wouldn't accept the client certificate I'd gotten from VeriSign, nor would it accept a different one from another CA, Nortel (http://www.nortel.com/). Finally, I discovered that client certificates from Xcert did work with Sioux.

What was different? Xcert's lead developer Pat Richard says there's an ambiguity in how to encode X.509 certificates, and that Xcert supports both interpretations.

How does the server read the fields of a client certificate? Sioux exports these as Common Gateway Interface (CGI) variables. Its built-in Python interpreter can straightforwardly access the certificate's data (see the listing "Reading a Client Certificate with Sioux" on page 116). So you could use CGI scripts to regulate access to areas of a site. A script might match the certificate's name and e-mail address against a database of registered users. Or it could just verify the identity of the certificate's signer. If you're issuing your own brand of certificates, that might be all you need to know. Because Sioux uses Python internally, there's no per-script process-creation overhead. Despite this best-case scenario, however, it would be expensive to run Python code every time a browser requested a page.

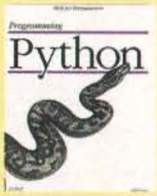
TOOLWATCH

Xcert Demo CA
http://www.xcert.com/

With the public CA tools at this site, you can generate the client and server certificates you'll need to develop and test SSL-oriented Web applications.

BOOKNOTE

Programming Python
($44.95)
by Mark Lutz
O'Reilly and Associates
http://www.ora.com/catalog/python/



A comprehensive guide to Python, a powerful and increasingly popular object-oriented scripting language.

There's a faster, cleaner way. Using the `SSL_Require` directive, you can simply declare in a configuration file that access to an area of your Web site requires a client certificate whose fields contain specified values. For example:

```
<directory /web/docs>
SSL_Require SSL_CLIENT_IO=“BYTE”
</directory>
```

says that `/web/docs` is open only to browsers presenting BYTE-issued certificates. That's not enough, though. On whose authority will you accept the certificate's data as valid? After all, anyone can go to Xcert's site and create a client certificate whose fields say anything at all.

There has to be a way to trust only certificates issued by a particular CA, possibly your own. The situation is analogous to server authentication. The list of CA certificates preloaded in your browser enumerates the authorities whose server certificates you agree to accept. Similarly, in Sioux, you can install CA certificates that define the authorities whose client certificates your server will accept. In theory, I should have been able to install my own Xcert CA certificate—that is, the certificate of the test CA I created at http://www.xcert.com—and thereby accept only "BYTE-brand" client certificates issued by that CA.

In practice, I never got this to work. Should the CA certificate have been in Privacy-Enhanced Mail (PEM) rather than Distinguished Encoding Rules (DER) format? While sorting through the options, it all became a moot point.

Thawte Consulting (http://www.thawte.com/), Sioux's creator, transferred ownership of the product to C2Net Software (http://www.c2.net/), creator of another secure Apache derivative called Stronghold. C2Net intends to incorporate Sioux's best features—embedded Python, GUI administration, and declarative certificate-based access filters—into a version of Stronghold that may be available in a beta version by the time you read this. (Thawte, meanwhile, will focus on competing with VeriSign in the CA business.) The Sioux/Stronghold hybrid sounds promising, and I'm eager to try it.

Authentication with IIS

BYTE's official VeriSign-supplied server certificate lives on http://www.byte.com. That server runs NT 3.51 and IIS 1.0c, a combination that does not support client authentication. IIS 3.0, which is basically version 2.0 plus Active Server Pages, can do client authentication, but only under NT 4.0. Microsoft's eagerness to make NT 3.51 obsolete strikes me as unseemly.

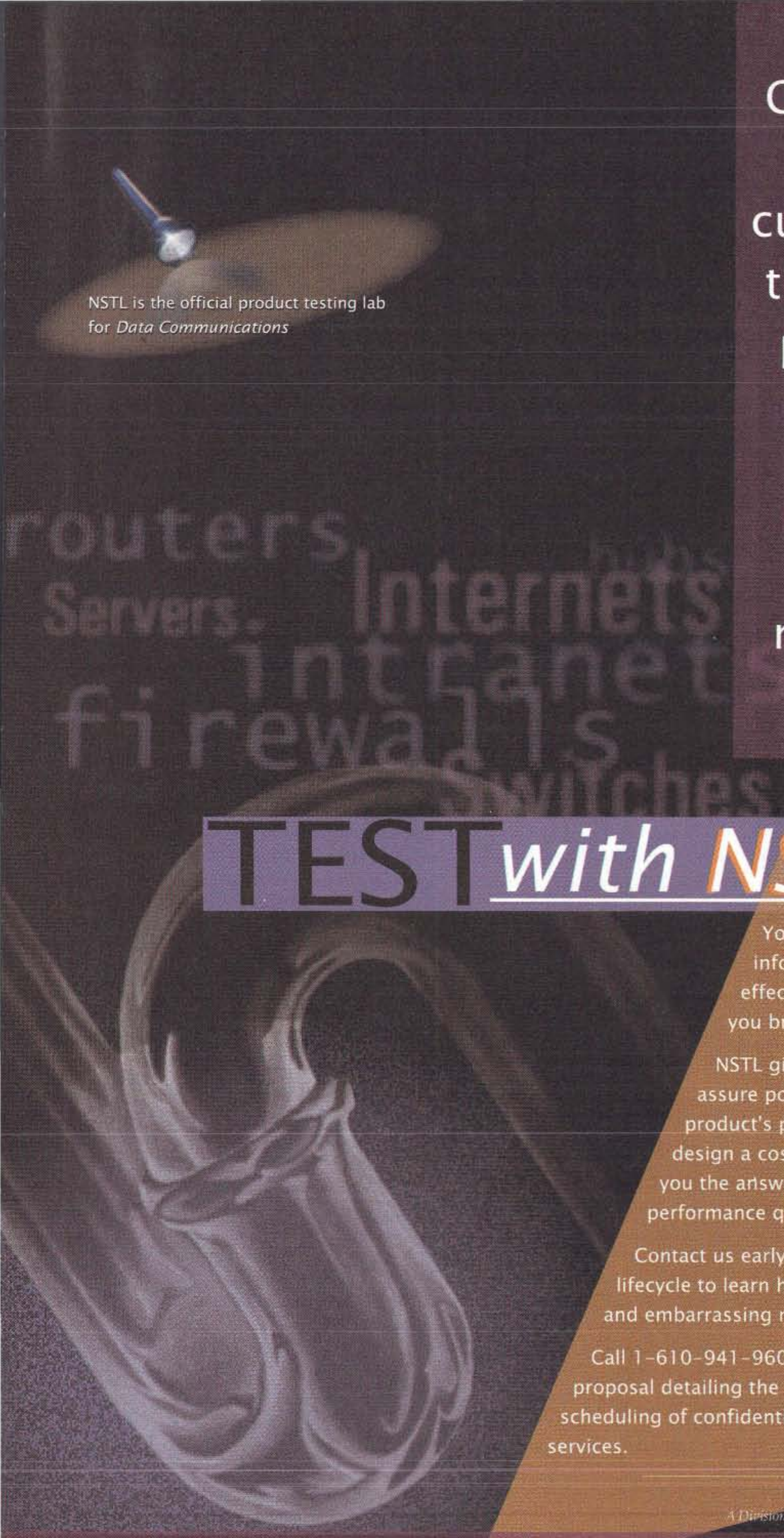
In IIS 3.0, a GUI application called Key Manager replaces the version 1.0 command-line tools keygen (which generates a key pair and a certificate-signing request) and setkey (which installs a signed certificate). I used Key Manager in conjunction with Xcert's public tools to install a server certificate on my test IIS 3.0 system. Then I used the IIS Internet Service Administrator to secure a virtual directory and to require client authentication for access to that directory.

Now or Later?

Solutions based on digital IDs are almost within reach. The supporting technologies, though raw and formative today, are evolving rapidly. They'll have to, because there's a huge burden of complexity attached to the use of digital IDs. Early adopters will shoulder more of that burden than stragglers. Is it worth the trouble? I expect it will be, but I'll admit that it's tempting to wait until things work more smoothly. **B**

---

*Jon Udell (**judell@bix.com**) is BYTE's executive editor for new media.*



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What's speed got to do with it? Everything.

By Andrew Froning and Helen Holzbaur

13 Modems: Fast for the Web

In BYTE's last roundup of V.34 modems (June 1995), our interest in speed was to save money on file transfers; higher data-transmission rates result in smaller phone bills. But in the year and a half since then, the Internet hit the scene. While high data-transfer rates still save money for those working from home or paying toll calls to an Internet service provider (ISP), the primary need for speed now is to reduce the wait for Web pages. The explosion of interest in the Web, coinciding with the introduction of flat rates from ISPs, has driven the demand for ever-faster modems, the primary link to the Web for home users.

One response from modem makers has been the introduction of an enhanced V.34 standard (approved by the International Telecommunication Union [ITU] last fall). V.34 enhancements include transmission rates of 31.2 and 33.6 Kbps over standard analog telephone lines. While the V.34 standard's rate change offers about a 17 percent possible performance increase over that of 28.8-Kbps modems, we measured around only an 8 percent gain. It's not enough to justify upgrading from 28.8 Kbps, but it's the best route for upgrading from 14.4 Kbps, particularly if ISDN isn't an option.

While we were testing the first crop of 33.6-Kbps modems, vendors were already announcing so-called 56K modems (see the Tech Focus on page 126). Capable of download rates of 56 Kbps, these devices could supplant 33.6-Kbps modems fairly quickly.

That shouldn't necessarily stop you from buying a 33.6-Kbps modem now, however; most vendors are just announcing policies for inexpensively upgrading 28.8- and 33.6-Kbps modems to a proprietary 56K capability. Once the ITU settles on a 56K standard, a final upgrade will be available for free from most vendors.

We tested 13 of the first enhanced V.34 modems. All are external models that you can use on several hardware platforms, although the test units all came with Windows software.

It's a varied lot, ranging in price from $109 for the modest Practical Peripherals PM336MT INET to $395 for Digicom Systems' ScoutPro and the U.S. Robotics Courier V.Everything/V.34. Eight vendors sent models offering some voice-messaging and/or speakerphone capabilities, although that wasn't a requirement for participation. Six of the modems offer flash ROM BIOS chips that allow you to upgrade the device using a vendor-supplied program.

BYTE BEST

HIGH-SPEED MODEMS

U.S. Robotics Courier V.Everything/V.34
is best overall and the best data modem, with top performance, features, and usability.

Zoom Telephonics V.34X Plus
is the best low-cost modem, at $189 (and a runner-up for best overall).

Our review doesn't include internal versions of 33.6-Kbps modems. Since they generally use the same data pumps and chip sets as their external cousins, the performance differences are minimal. Cost differentials are generally minimal as well; the average difference is about $20. All these products include fax capabilities at the highest standard rate (V.17) of 14.4 Kbps. We did not test fax performance, as previous tests have shown virtually no speed differentials.

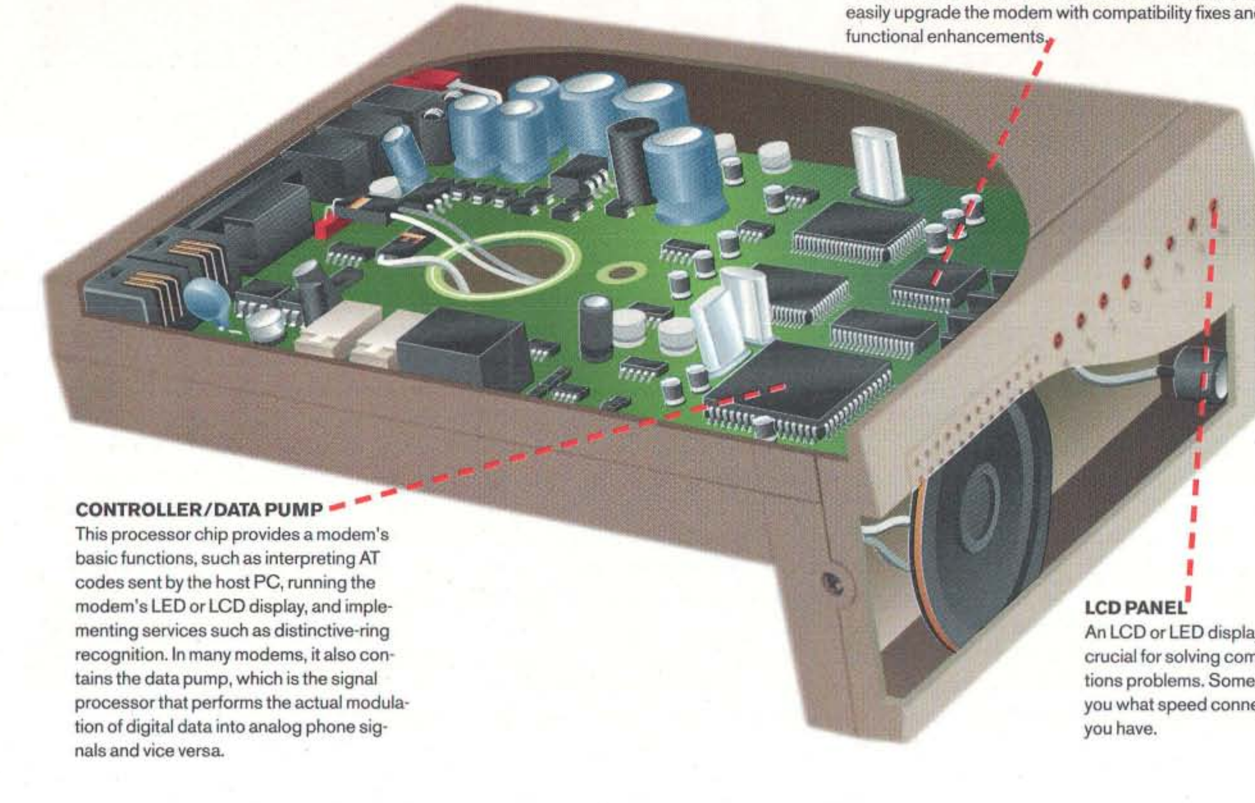
Speed Is Important

What must you know before making a decision about which model to buy? Speed is, of course, critical. We found a noticeable 15 percent difference between the fastest and slowest modems in our testing. And, as with 28.8-Kbps modems, there are several factors that can prevent you from using full V.34 speed.

First, you must connect to another V.34 modem. For companies supporting telecommuters, that means upgrading existing installations, and Web users must wait for their ISPs to upgrade their modem banks. A few older V.34 modems have programmable BIOS chips (flash ROM or EEPROM), which can be upgraded to the latest V.34 standard.

A second limiting factor is the quality of your phone lines. The number of lines that are "clean" enough for 33.6-Kbps transmission in the U.S. is estimated at 5 percent. However, the new V.34 specification also enhances a modem's transmission abilities on more-typical phone lines. So, even with less-than-perfect lines, a 33.6-Kbps modem will give you higher throughput than an older 28.8-Kbps model.

A third possible limitation is your computer's serial port. Modems compress data before transmitting it. To transmit compressed data at a 33.6-Kbps data communications equipment (DCE) rate, uncompressed data must flow into the



ROM
Permanent memory that holds things such as program routines for signal processing. If the ROM is flash memory, you can easily upgrade the modem with compatibility fixes and, often, functional enhancements.

CONTROLLER/DATA PUMP
This processor chip provides a modem's basic functions, such as interpreting AT codes sent by the host PC, running the modem's LED or LCD display, and implementing services such as distinctive-ring recognition. In many modems, it also contains the data pump, which is the signal processor that performs the actual modulation of digital data into analog phone signals and vice versa.

LCD PANEL
An LCD or LED display is crucial for solving communications problems. Some even tell you what speed connection you have.

Rear-Panel View

LINE JACKS
Two are preferred, one for the phone and one for the line coming from the wall jack, so that modem and phone can share a line.

Illustration based on Practical Peripherals PM336MT INET.

ILLUSTRATION: SANDERS/TIKKANEN DESIGN & ILLUSTRATION © 1997

modem at an even-higher data terminal equipment (DTE) rate. At the highest V.42bis compression ratio (a seldom-reached 4:1), the serial port must transmit at 115.2 Kbps. Few serial ports on older systems can handle this rate, or even 56.6 Kbps. (This isn't a problem with internal modems, because data comes off the expansion bus.) In either case, a 16550-compatible universal asynchronous receiver/transmitter (UART) is another requirement for fast data flow.

In addition to speed, another desirable feature is a flash ROM BIOS chip and/or EEPROM. Since most modern modems use DSPs (digital signal processors), vendors can upgrade the operation of the DSP using a reprogrammable BIOS chip. That way, they can add features, improve compatibility, or upgrade to new standards without having to open the modem.

A speakerphone function is important for telecommuters and home-office users. While some modems have built-in speakers and microphones, some buyers might also want to be able to connect a modem directly to their computer's sound card or even use a headset.

Key features for home-office users are support for caller ID and distinctive ringing. Caller ID lets you identify a caller's phone number before picking up. Eight modems in this review offer this feature. (Note: Bundled software doesn't always support caller ID.) Distinctive ringing is a telco service that allows several different phone numbers to use the same line. You can, for instance, dedicate one number to voice calls and a second to fax and data calls and then configure the modem to answer one ring and not the other—if the modem supports distinctive ringing.

We rated the modems primarily on their speed (which constitutes 40 percent of the total score). NSTL's speed tests look at transmission rates under normal line conditions (representing half the calls made in the U.S.); under heavily impaired conditions (the most stressful, but rarely encountered); and under the conditions specified by the TIA standards body, which represent more than 90 percent of all the calls made in the U.S. We also rated the products for feature sets and usability.

While we didn't include bundled communications software in the ratings (see the text box "Software: Bundle or Burden?" on page 122), we installed each package to get a feel for its form and function. All modems with voice features also had software for setting up voice mailboxes; most also offered fax-back functions as well.

Contributors

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Best Overall

33.6-KBPS MODEMS

The U.S. Robotics Courier V.Everything, the fastest modem in NSTL's performance tests, is also the Best Overall winner. The Courier's extruded aluminum case is a throwback to the early days of modem design, but the modem powered through the performance tests, gathering top marks in all but one of them. It also comes with an excellent set of documentation. U.S. Robotics doesn't offer voice or speakerphone functions with the Courier—just a solid design and robust performance.

The first runner-up in the Best Overall category was the Zoom Telephonics V.34X Plus. The $189 V.34X provided plenty of zip in our performance tests, finishing fourth overall. Packaged in a small plastic case, the V.34X won't take up much space on your desktop. It comes with Delrina's WinFax and DosFax Lite software. One feature that we liked about the V.34X was its front-mounted power switch, a convenient way to recover from a modem crash.

Of the modems with voice functions, Diamond's SupraSonic 336V+ and Cardinal's MVPV34XSP 33.6 Speakerphone gave the best overall performance. Both products provide connectors for external speakers and a microphone for your system's sound card. The Cardinal modem also provides an internal speaker. While this device has a microphone, the SupraSonic comes with a lightweight headset. The SupraSonic also features LEDs (indicating send-data and receive-data activity) and a two-line LCD that describes completely, albeit tersely, all modem activity. The MVPV34XSP 33.6 relies strictly on seven LEDs to indicate what's happening. Having status indicators is a plus for dedicated modem users; they provide visual clues for solving connection problems.

Based on its next-to-best-overall rating, the Zoom V.34X Plus moved right to the top of the list in our Low Cost category. (BYTE selected $200 as the price cutoff point.) With its excellent performance and no-frills pricing, the V.34X is a good choice for budget-aware people who want performance but don't need voice functions.

Following right behind the V.34X in this category is Cardinal's MVPV34XSP 33.6, with its good mix of performance, features, and value. Also scoring high is Motorola's VoiceSURFR 33.6. The VoiceSURFR provides connectors for an external speaker/microphone or a sound card, as well as LEDs for monitoring modem status. The VoiceSURFR, however, failed two of the six conditions in our impaired-line testing. The failed lines are conditions basically encountered while making overseas calls and are not likely to cause a problem for most U.S. users.

As the fastest modem we tested, U.S. Robotics' V.Everything, our Best Overall Modem, also takes the Best Data Modem category. While most of the other modem vendors use a Rockwell chip set, U.S. Robotics uses its own. The Courier pushed data through at nearly 91 percent of the theoretical maximum in NSTL's file-throughput tests, giving the best performance by a substantial margin over the first two runner-up devices, the Cardinal MVPV34XPSP 33.6 Speakerphone and Logicode's Quicktel II 33X-ASP-C.

The Quicktel II provides strong voice functionality with its built-in speaker and microphone, external connections for same, and voice-over-data capability. The modem also comes with Smith Micro's full-featured QuickLink II fax/voice/data software and Intel's ProShare conferencing software.

Software: Bundle or Burden?

You shouldn't choose a modem just because of its bundled software, but you shouldn't leave it completely out of your buying decision, either. All the tested modems came with Windows-based communications software programs. While Windows 95 provides much better modem support than Windows 3.x did, that's not saying much. Third-party communications programs, however, now help fill the gap between simple fax/data needs and managing all your personal communications requirements.

Motorola, for example, includes Smith Micro's QuickLink Message Center software with its VoiceSURFR modem. This program handles voice mail, faxing (including fax-back), and data communications. A one-screen program interface allows you to see and handle all three kinds of calls (voice, fax, and data). You can also install multiple greetings and mailboxes and operate the VoiceSURFR as a speakerphone. Four of the 13 modems in this review came bundled with some type of Smith Micro software.

Hayes provides its SmartCom Message Center Pro with the Accura 336 modem. This program offers voice mail with multiple mailboxes, remote entry, and multiple greetings. SmartCom operates using a central window with program selections for different operations (e.g., fax, voice, and data). We preferred QuickLink's all-in-one interface, however.

Other notable software that comes bundled with the reviewed modems includes SmartCom LE, which comes with Practical Peripherals' PM336MT. Global Village's Focal Point software, included with its TelePort 33.6, provides functions such as e-mail management and address-book entries for pagers, in addition to voice, fax, and data functions. We liked its clean interface and tight integration with Win 95; it can configure e-mail settings with MAPI information from the Microsoft Exchange client.

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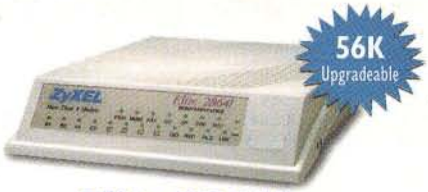

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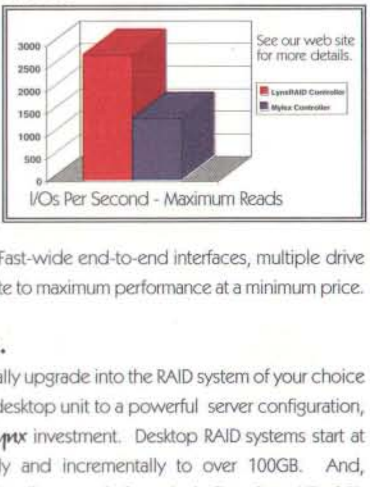

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Circle 179 on Inquiry Card.

LAB RESULTS

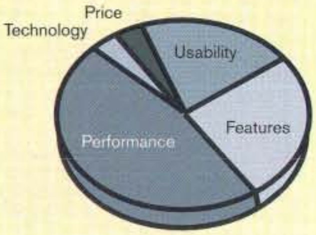
MODEM RATINGS

BEST OVERALL

U.S. Robotics Courier V.Everything/V.34

Top performance, excellent documentation, and business-like features make the Courier BYTE's choice for Best Overall among the 33.6-Kbps external modems tested. Achieving an average of 91 percent of the maximum possible performance in NSTL's throughput tests, the Courier also had excellent results in both the impaired-line and TIA tests.

WEIGHTING



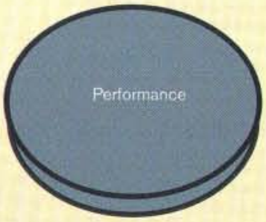
	PRICE	TECHNOLOGY	IMPLEMENTATION	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
U.S. Robotics Courier V.Everything/V.34	**$395**	★★★★	★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Zoom V.34X Plus	$189	★★★★	★★★★	★★★★	★★★★	★★★★★	★★★★
Diamond SupraSonic 336V+	$249	★★★★	★★★★	★★★★	★★★★	★★★★★	★★★★
Cardinal MVPV34XSP 33.6 Speakerphone	$169	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
Motorola VoiceSURFR 33.6	$179	★★★★	★★★	★★★★	★★★	★★★★	★★★
Digicom ScoutPro	$395	★★★★	★★★	★★★★	★★★	★★★★	★★★
Logicode Quicktel II 33X-ASP-C	$270	★★★★	★★★	★★★★	★★★★	★★	★★★
Boca V34 33.6 BOCAMODEM	$239	★★★★	★★★	★★★★	★★	★★★★	★★★
Best Data SmartOne 33.6 FLX	$159	★★★★	★★★★	★★★	★★★★	★★★★	★★★
Practical Peripherals PM336MT INET	$109	★★★★	★★★	★★★★	★★★	★★	★★★
Global Village TelePort 33.6 Speakerphone	$239	★★★★	★★★	★★★★	★★★★	★★	★★★
Hayes Accura 336	$169	★★★★	★★★	★★★★	★★★★	★★	★★★
Archtek SmartLink 3334AV	$209	★★★★	★★	★★★★	★★★	★	★★

BEST DATA MODEM

U.S. Robotics Courier V.Everything/V.34

The criterion for Best Data Modem is speed and only speed. BYTE uses the results of NSTL's throughput, impaired-line, and TIA tests to measure modem performance. The Courier V.Everything/V.34 finished first in the throughput tests (especially in the two-way transfer tests) and had above-average performance in all the other tests.

WEIGHTING



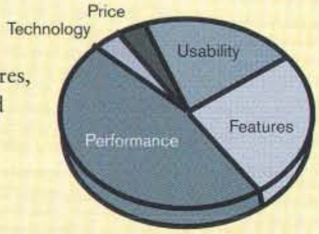
	PRICE	TECHNOLOGY	IMPLEMENTATION	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
U.S. Robotics Courier V.Everything/V.34	**$395**	★★★★	★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Cardinal MVPV34XSP 33.6 Speakerphone	$169	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
Logicode Quicktel II 33X-ASP-C	$270	★★★★	★★★	★★★★	★★★★	★★	★★★
Zoom V.34X Plus	$189	★★★★	★★★★	★★★★	★★★★	★★★★★	★★★★

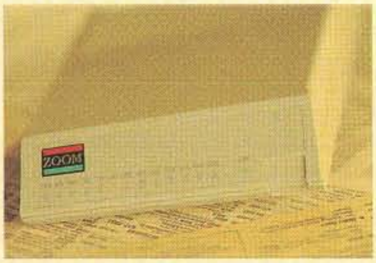
LOW-COST MODEM

Zoom Telephonics V.34X Plus

The V.34X Plus offers the second-best-overall score and a price of just $189. If you're looking for voice features, both the Cardinal MVPV34XSP 33.6 Speakerphone and Motorola's VoiceSURFR 33.6 modems provide speakerphone capability for under $200.

WEIGHTING





	PRICE	TECHNOLOGY	IMPLEMENTATION	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
Zoom V.34X Plus	**$189**	★★★★	★★★★	★★★★	★★★★	★★★★★	★★★★
Cardinal MVPV34XSP 33.6 Speakerphone	$169	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
Motorola VoiceSURFR 33.6	$179	★★★★	★★★	★★★★	★★★	★★★★	★★★
Best Data SmartOne 33.6 FLX	$159	★★★★	★★★★	★★★	★★★★	★★★★	★★★

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

PHOTOGRAPHS: BRIAN WILDER © 1997

Details

Ever-Ready

One problem with PC telephony products is that you typically must run the PC to use the phone. You either waste power leaving your system on or waste time waiting for it to boot. Global Village Communication's TelePort 33.6 Speakerphone Edition modem can act as a speakerphone regardless of whether the host PC is on—something that the other speakerphone units can't do.

Phone-Friendly

Among the modems we tested with speakerphone capabilities, only Diamond Multimedia Systems' SupraSonic 336V+ comes with a headset, a boon to those who spend their day talking on the telephone and want top sound quality. Other desirable features include a front-mounted LCD display and a power switch.

Switch-Hitter

You can stack Logicode's Quicktel II modems horizontally, nesting them one on top of the other, or you can stand one upright. The LCD display adjusts itself accordingly.

TECH FOCUS 56K MODEMS

Web Use Drives New 56-Kbps Standard

Downloading complex Web pages on even a 28.8-Kbps modem can exhaust anyone's patience. Help is on the way, however, in the form of modems that offer download-transmission rates of 56 Kbps. Products should start hitting the street about the time this sees print.

The so-called 56K technology is fast, but because of the nature of phone-company switching, it's asymmetrical. If there's an A/D conversion somewhere in a connection, you're limited to 33.6 Kbps. That means you get 56K only during downloads from an Internet service provider (ISP) with a direct digital connection to the Internet's main trunk lines (where there's only D/A conversion). Most server modems (the industrial-strength ones ISPs use at their server sites) connect to the Internet over digital T1 lines with rates up to 1.5 Mbps.

The new 56K technology takes advantage of the digital nature of central offices by using a digital pulse code modulation (PCM) to send the data from the server to the user's modem at rates up to 56 Kbps. This encoding technology requires that a user's modem be synchronized to the network's clock rate of 8 MHz.

In brief, 56K technology uses changes in voltage amplitude to send binary data. Sampled at 8000 times per second, each sample can theoretically carry 8 bits of data, or 64 Kbps total. However, noise factors currently restrict data flow to 7 bits per second per sample, or 56 Kbps. Thus, data can flow down the standard two pairs of twisted-copper lines at the high rate in a digital form. Data flowing upstream travels at the best-possible V.34 analog speed.

For most Web users, one-way 56K isn't a bad scenario, since most of the data traffic flows from the server to the client. Mouse-clicks and the occasional text entry will fly upstream, and users could nearly double the speed of downloading pages over their present 28.8-Kbps modems.

There are other advantages as well. Modems with flash ROMs may be able to upgrade to 56K technology for a small cost. Unlike ISDN, which offers true digital transmission with two 64-Kbps channels, 56K won't require the user to install new lines or add extra-cost services. It will work just fine on existing wiring and phone connections.

But there are still some potential monkey wrenches flying about. Most have to do with that old computer-industry bugaboo, standards. Early this year, there were two principal camps pushing different approaches to 56K. On one side is U. S. Robotics (USR), with its homegrown technology supported mostly by the company and a substantial number of ISPs, supposedly those with a heavy investment in USR technology.

On the other side of the chasm stands the key player in the digital signal processor (DSP) market, Rockwell Semiconductor Systems. Allied with Rockwell are Lucent Technologies, another semiconductor giant, and Motorola, which makes semiconductors and modems. Also betting on Rockwell are most of USR's competitors in the modem market, who buy their DSPs from Rockwell, Lucent, and Motorola.

Whoever can convince the International Telecommunication Union to accept their version of 56K technology will gain a big advantage in the 56K modem marketing arena. The outcome of this battle may take most of this year, stunting the growth of this potentially useful technology. Stay tuned to the pages of BYTE to see who comes out on top.

Test Specs

We requested two modems from every vendor and then used matched pairs for performance testing with a TAS Series II phone-system emulator from Telcom Analysis Systems (Eatontown, NJ). We connected each modem to the TAS via Dell Dimension 75 Pentium computers with 16550 UARTs connecting at DTE rates of 115.2 Kbps.

NSTL uses three test suites, each designed to show a different facet of modem performance. The throughput tests measure the speed at which the modems transmit data on relatively unimpaired lines, which mimic about 50 percent of all calls made in the U.S. This test comes closest to measuring the modems' performance as most people would use them in the U.S.

During these tests, the modems transfer three different types of files—compressed, graphics, and text—ranging in size from 131 to 333 KB, at the fastest rate possible for both one- and two-way transmissions. The large file sizes push a modem's compression engine, because not all the data can be cached in the engine's on-board dictionary.

Under a one-way transmission, modem A calls modem B, sends a file, and hangs up. Modem A then repeats the process until consistent results are achieved. Modem B only receives data; it does not send anything back to modem A. During the two-way tests, modem A still calls modem B. But when modem B answers, both devices simultaneously send files to each other.

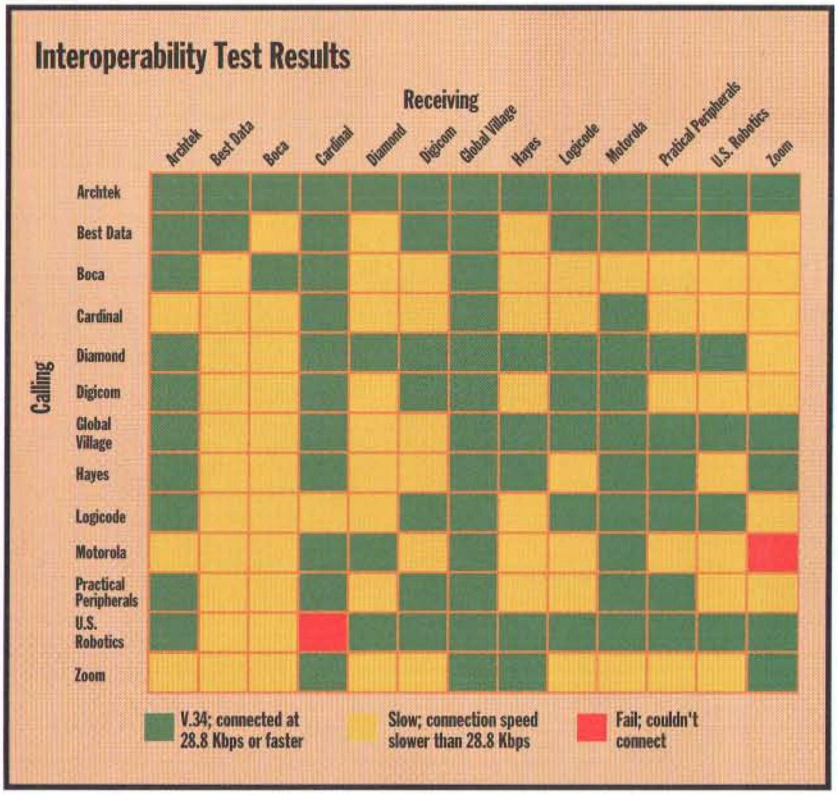
The impaired-line tests simulate tougher-than-normal line conditions and do the best job of separating the best-designed modems from the rest. We used three lines resembling those described in the International Telecommunication Union (ITU) Telecommunications Systems Bulletin (TSB) 37A, and two more from the ITU V.56bis specification for intercontinental data transmission, ratified in August 1995. To pass, each modem must successfully make four connections in six tries for each file and line condition. Of the two modems that failed to complete the test, Motorola's VoiceSURFR failed on two international lines, and Digicom Systems' ScoutPro on one.

The network-model tests measure the speed at which a modem can transfer data over the line conditions specified in Table 6 of bulletin TSB 37A. This document, created by the ITU, defines lines that model the U.S. telephone network. The 36 lines in Table 6 represent 90.55 percent of all calls made in the continental U.S.

Briefly, the procedure detailed in TSB 38 requires modem A to call modem B and send a defined, moderately compressible file that's approximately 32 KB long. To transmit approximately 300 KB, modem A sends the file 10 times before hanging up.

We also tested interoperability by connecting every test modem with every other one (see the figure "Interoperability Test Results" above), but we didn't include the interoperability results in our product ratings. Poor interoperability, which is common with a new standard, is typically corrected quickly.

While every modem worked well with another of its own model, few worked as well with other models. Often, a hybrid combination resulted in data speeds somewhat slower than 28.8 Kbps, but there were two downright failures. The Archtek SmartLink 3334AV proved to be the most compatible, the Boca Research V34 33.6 the least. Interoperability is not necessarily symmetrical. For example, the Best Data SmartOne 33.6 FLX established faster connections when calling than it did when receiving.



Interoperability Test Results

Calling \ Receiving	Archtek	Best Data	Boca	Cardinal	Diamond	Digicom	Global Village	Hayes	Logicode	Motorola	Pratical Peripherals	U.S. Robotics	Zoom
Archtek	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
Best Data	🟩	🟩	🟨	🟩	🟨	🟩	🟩	🟨	🟩	🟩	🟩	🟩	🟨
Boca	🟩	🟨	🟩	🟩	🟨	🟨	🟩	🟨	🟨	🟨	🟨	🟨	🟨
Cardinal	🟨	🟨	🟨	🟩	🟨	🟨	🟩	🟨	🟨	🟩	🟨	🟨	🟨
Diamond	🟩	🟨	🟨	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨
Digicom	🟩	🟨	🟨	🟩	🟨	🟩	🟩	🟨	🟩	🟩	🟨	🟨	🟨
Global Village	🟩	🟨	🟨	🟩	🟨	🟨	🟩	🟩	🟩	🟩	🟩	🟩	🟩
Hayes	🟩	🟨	🟨	🟩	🟨	🟨	🟩	🟩	🟨	🟩	🟩	🟨	🟩
Logicode	🟩	🟨	🟨	🟨	🟨	🟩	🟩	🟨	🟩	🟩	🟩	🟩	🟨
Motorola	🟨	🟨	🟨	🟩	🟩	🟨	🟩	🟨	🟨	🟩	🟨	🟨	🟥
Practical Peripherals	🟩	🟨	🟨	🟩	🟨	🟩	🟩	🟨	🟨	🟩	🟩	🟨	🟨
U.S. Robotics	🟩	🟨	🟨	🟥	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
Zoom	🟨	🟨	🟨	🟩	🟨	🟨	🟩	🟩	🟨	🟨	🟨	🟨	🟩

🟩 V.34; connected at 28.8 Kbps or faster
🟨 Slow; connection speed slower than 28.8 Kbps
🟥 Fail; couldn't connect

We found that the first group of 33.6-Kbps modems generally work together, but not often at full speed.

Evaluations in this report represent the judgment of BYTE editors, based on tests conducted by NSTL, Inc., as documented in a recent issue of their monthly PC Digest. *To purchase a copy of the full report, contact NSTL at 625 Ridge Pike, Conshohocken, PA 19428; (610) 941-9600; editors@nstl.com. For a subscription, call (800) 328-2776. BYTE magazine and NSTL are both operating units of The McGraw-Hill Companies, Inc.*

MODEMS FEATURES

	Archtek America Corp. SmartLink 3334AV	**Best Data Products, Inc. SmartOne 33.6 FLX**	**Boca Research, Inc. V34 33.6 BOCAMODEM**	**Cardinal Technologies, Inc. MVPV34XSP 33.6 Speakerphone**	**Diamond Multimedia Systems, Inc. SupraSonic 336V+**	**Digicom Systems, Inc. ScoutPro**
Price as tested (MSRP)	$209	$159	$239	$169	$249	$395
Overall rating	★★	★★★	★★★	★★★★	★★★★	★★★
GENERAL						
Pin configuration	25-pin	25-pin	25-pin	25-pin	25-pin	25-pin
Maximum DTE rate (Kbps)	115.2	115.2	115.2	115.2	230.4	116.24
SPOOFING						
ENQ/ACK spoofing		✓				
X/Y modem spoofing		✓	✓			
Kermit spoofing		✓	✓			
UUCP spoofing		✓				
GENERAL-PURPOSE FEATURES						
Caller ID	✓	✓		✓	✓	✓
Paging	✓	✓		✓	✓	
Distinctive ring		✓		✓	✓	
Speakerphone	✓		✓	✓	✓	
Voice over data (DSVD)						
Voice compression	✓	✓		✓	✓	
DTMF	✓	✓	✓	✓	✓	
Flash EPROM				✓	✓	
Flash BIOS					✓	
Volume-control knob						
Supports 56K upgrade			✓	✓		
Adaptive speed leveling (ASL)		✓				✓
BACKBONE FEATURES						
Autobaud all speeds	✓	✓	✓	✓	✓	✓
Select speeds	✓	✓	✓		✓	✓
Blacklisting					✓ (via country-code settings)	
Callback security						
Carrier-loss redial	✓[2]	✓[2]		✓[2]		✓
Dictionary sizing		✓			✓	
Remote configuration				✓		
Synchronous communication					✓	✓
LEASED-LINE SPECIFICATIONS						
Two-wire	✓					✓
Dial-up backup						✓
Leased-line look-back						✓
Time windows						
COMMON STANDARDS						
Class 1 fax	✓	✓	✓	✓	✓	✓
Class 2 fax		✓	✓		✓	✓
MNP 10 error control		✓	✓	✓	✓	✓
V.17, V.22bis, V.32, V.32bis, and V.34	✓	✓	✓	✓	✓	✓
V.23 (1200 bps)	✓	✓		✓	✓	✓
V.25bis	✓	✓				✓
V.32ter (AT&T 19.6 Kbps)	✓		✓			✓
V.fast		✓	✓			✓
V.fc		✓	✓	✓	✓	✓
HST						✓
SOFTWARE	QuickLink Message, Center 3.0 AOL, CompuServe	QuickLink II	FaxWorks, AOL, CompuServe, NetCom NetCruiser	FaxTalk Messenger	FaxTalk Messenger, Comit for Windows	QModem
CUSTOMER SUPPORT						
Warranty length (years)/coverage	5/P, L, R	5/P, L, R	5/P, L, R	Lifetime limited	5/P, L, R	3/P, L
FCC rating	B	B	B	B	B	B
Phone	(818) 912-9800	(818) 773-9600	(561) 997-6227	(717) 293-3049	(360) 604-1400	(408) 262-1277
Toll-free phone	N/A	N/A	N/A	(800) 775-0899	(800) 727-8772	(800) 833-8900
Web address	http://www.archtek.com/	http://www.bestdata.com/	http://www.bocaresearch.com/	http://www.cardtech.com/	http://www.diamondmm.com/	www.digicomsys.com/
Inquiry number	**1058**	**1059**	**1060**	**1061**	**1062**	**1063**

BYTE BEST = BYTE Best

✓ = yes;
N/A = not applicable.

Warranty: P = parts; L = labor;
F = freight to repair center; R = return to customer.

[1] AudioSpan (ASVD). [2] Software-independent. [3] Estimated street price.

Global Village Communication TelePort 33.6 Speakerphone Edition	**Hayes Microcomputer Products, Inc. Accura 336 Office Communications Manager**	**Logicode Technology, Inc. Quicktel II 33X-ASP-C**	**Motorola, Inc. (Mobile Computing Products Division) VoiceSURFR 33.6**	**Practical Peripherals, Inc. PM336MT INET**	**U.S. Robotics Corp. Courier V.Everything/ V.34** BYTE BEST	**Zoom Telephonics, Inc. V.34X Plus** BYTE BEST
$239	$169³	$270	$179	$109³	$395	$189
★★★	★★★	★★★	★★★	★★★	★★★★★	★★★★
9-pin	9-pin	25-pin	25-pin	25-pin	25-pin	25-pin
115.2	115.2	115.2	115.2	115.2	115.2	115.2
					✓	
✓	✓	✓	✓		✓	
✓	✓		✓	✓		
✓	✓	✓			✓	✓
✓	✓	✓	✓	✓		
✓[1]	✓	✓[1]				
✓	✓	✓				
✓	✓	✓	✓	✓	✓	✓
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		✓			✓	
✓					✓	
✓					✓	✓
✓	✓			✓	✓	✓
✓	✓	✓	To 2400	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓
✓					International models only	
					✓	
					✓	
✓		✓			✓	✓
					✓	
✓					✓	
		✓			✓	
✓						
✓	✓	✓	✓	✓	✓	✓
	✓				✓	✓
✓		✓	✓			✓
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓			✓	✓
	✓				✓	
					✓	
✓	✓	✓			✓	✓
✓	✓	✓			✓	✓
					✓	
Focal Point	Quarterdeck Internet Suite 2, Quarterdeck WebTalk, Smartcom Message Center Pro	QLMCW 2.2, Intel ProShare 1.9	Message Center	QuickLink II, WebTalk Scan	Stampede, Remote Office Gold, QuickLink II	Comit, Winfax, DOSfax
5/P, L, F, R	2/P, L, R	Lifetime	5/P, L, R	Lifetime limited	5/P, L, F, R	7/P, L, R
B	B	B	B	B	B	B
(408) 523-1000	(770) 840-9200	(805) 383-2500	(205) 726-0798	(770) 840-9200	(847) 982-5010	(617) 423-1072
(800) 329-9675	(800) 429-3739	(800) 735-6442	(800) 566-3266	N/A	(800) 877-2677	(800) 631-3116
http://www.globalvillage.com/	http://www.hayes.com/	http://www.logicode.com/	http://www.mot.com/modems/	http://www.practinet.com/	http://www.usr.com/	http://www.zoomtel.com/
1064	**1065**	**1066**	**1067**	**1068**	**1069**	**1070**

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

OLAP Serves Up Your Data

When you're serious about mining enterprise-wide data, you need an industrial-strength tool like Arbor's Essbase or Oracle's Express Server.

By Mark Hettler

While relational databases are still the most common data management tools in systems ranging from mainframes to desktops, a newer approach specifically designed for analyzing data is making its mark on the industry. On-line analytical processing (OLAP), only a few years old, is a powerful model that's seemingly tailor-made for the massive amounts of information in today's data warehouses. At several thousand dollars per seat, though, OLAP is not for the casual user.

What's OLAP, Doc?

A fundamental need in modern data analysis is to be able to view selected attributes in a multidimensional manner rather than as 2-D arrays of rows and columns. The OLAP model treats each attribute as a dimension in a multidimensional structure, and each data element is tied to the intersection of these dimensions. This model allows analysts to slice and dice data in different 2-D views depending on the information needed, such as sales of different products over time or sales to various customer types in different regions.

The two products evaluated here—Arbor Software's Essbase 4.1 and Oracle's Oracle Express Server 6.0—are the acknowledged market leaders in OLAP servers. Instead of having software perform a multidimensional analysis of data that's physically stored in 2-D relational form, these programs actually store data in a multidimensional structure.

Such databases are sometimes referred to as *physical cubes* (see the Tech Focus on page 132). Both products allow hierarchies within a dimension, such as years broken down into quarters and months, or products grouped together into divisions. Both allow the use of popular spreadsheet programs for viewing and analyzing the data, and both provide Web gateways. Each product also provides access to data stored in relational databases, both by importing data directly from a relational database and by allowing SQL queries at run time.

Interestingly, it was E. F. Codd, the father of relational databases, who coined the term *OLAP*, contrasting it with on-line transaction processing (OLTP). In a white paper, Codd set forth 12 rules (the same number as his relational rules) for creating sound OLAP systems. Thus, Codd communicated a not-so-subtle message that he considered the two types of databases equally valid and that they should exist side by side. Codd went on to argue that multidimensional databases are better suited than relational databases for certain aspects of data processing.

BYTE BEST
OLAP SERVER

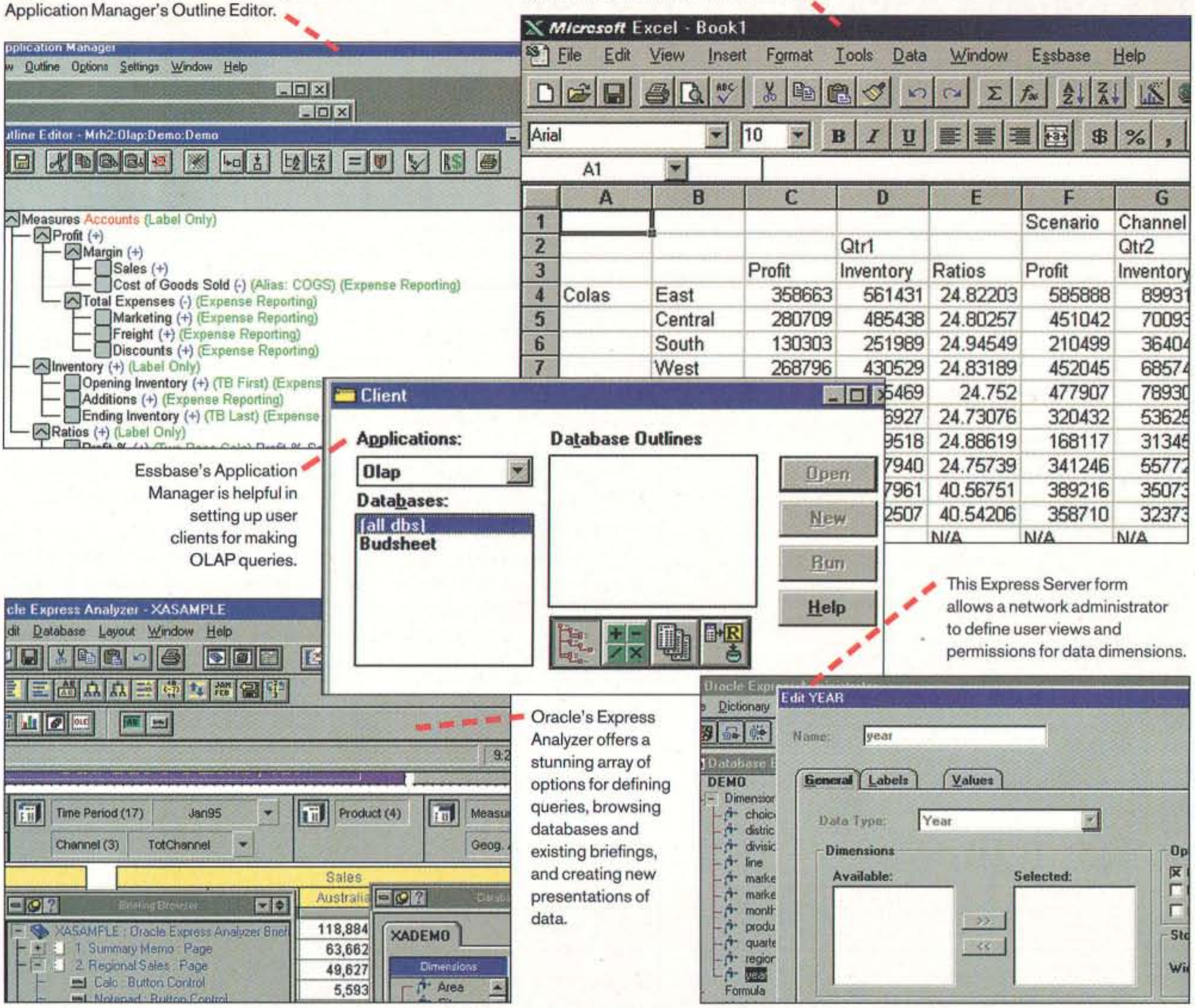
Arbor Software's Essbase offers easy, drag-and-drop design of dimensions, measures, hierarchies, and databases. Loading data is easy, one command recalculates the entire database, and the spreadsheet interface provides accessible analytical and update capabilities.

Codd's white paper has been criticized on the grounds that it was commissioned by Arbor Software and is thus prone to bias. But such criticisms miss the point: Although Codd's paper did indeed include a section extolling Essbase, its overall impact was not to establish Essbase as superior to its competitors, but to legitimize OLAP as a viable database product category. The endorsement of so formidable a proponent of relational technology as Codd was arguably the most significant factor in opening the door to a plethora of new products, as well as revitalizing some older product lines that had come to be viewed as outdated legacy systems.

Data in a multidimensional database typically comes from relational databases used for transaction-oriented production systems and for data warehouses. Both Essbase and Oracle Express Server can import data from relational databases using Open Database Connectivity (ODBC) drivers. Both can import dimension members (e.g., the names of the products in a products dimension, or the names of the regions in a regions dimension) and can import relational data into a multidimensional structure.

Both products also support *pivoting*, which is moving a dimension to another location in a spreadsheet; for example, you could move months to display down the side and move products to display across the top, or display sales offices within products rather than products within sales offices.

In general, there is a performance trade-off between precalculated data, for which the system stores the results, and calculations that the system executes at analysis time. Precalculation takes some time to execute, but it greatly speeds up queries. Virtual calculations, which Express Server uses, don't require explicit recalculation when the underlying data



Setting up hierarchical measures (i.e., data types) is simple in Essbase; it's presented clearly in the Application Manager's Outline Editor.

```
Measures Accounts (Label Only)
  Profit (+)
    Margin (+)
      Sales (+)
      Cost of Goods Sold (-) (Alias: COGS) (Expense Reporting)
    Total Expenses (-) (Expense Reporting)
      Marketing (+) (Expense Reporting)
      Freight (+) (Expense Reporting)
      Discounts (+) (Expense Reporting)
  Inventory (+) (Label Only)
    Opening Inventory (+) (TB First) (Expens
    Additions (+) (Expense Reporting)
    Ending Inventory (+) (TB Last) (Expense
  Ratios (+) (Label Only)
```

This spreadsheet view illustrates Essbase's ability to use hierarchical data dimensions.

	A	B	C	D	E	F	G
1						Scenario	Channel
2				Qtr1			Qtr2
3			Profit	Inventory	Ratios	Profit	Inventory
4	Colas	East	358663	561431	24.82203	585888	89931
5		Central	280709	485438	24.80257	451042	70093
6		South	130303	251989	24.94549	210499	36404
7		West	268796	430529	24.83189	452045	68574
				5469	24.752	477907	78930
				6927	24.73076	320432	53625
				9518	24.88619	168117	31345
				7940	24.75739	341246	55772
				7961	40.56751	389216	35073
				2507	40.54206	358710	32373
					N/A	N/A	N/A

Essbase's Application Manager is helpful in setting up user clients for making OLAP queries.

Applications: Olap

Databases: {all dbs}, Budsheet

This Express Server form allows a network administrator to define user views and permissions for data dimensions.

Name: year

Data Type: Year

Oracle's Express Analyzer offers a stunning array of options for defining queries, browsing databases and existing briefings, and creating new presentations of data.

Serious analysis of enterprise data often requires the structural advantages of these multidimensional OLAP servers.

changes, but queries take longer because calculations must be performed while the queries execute.

Essbase data is hierarchically organized and can be consolidated in many ways, but without *virtual measures* (formulas calculated at run time without the result being stored in the database), some values must be precalculated. Express Server allows this, but its lack of hierarchies and its inflexible consolidation process sometimes require execute-time calculation.

Arbor Software's Essbase

Arbor Software was the first vendor to seriously challenge the dominance of the relational model for large-scale databases when it introduced Essbase in 1993. And that early start shows in Essbase's overall power, ease of use and learning, and general maturity.

When choosing between two powerful products, where either one can fully meet your functionality needs, the choice comes down to usability or "deployability," the ability to surmount learning-curve issues quickly and get a working OLAP system on-line and functioning in minimal time. Once deployed, the system can be enhanced and customized through a relatively quick selection of options without the need for any programming.

Essbase offers a convenient drag-and-drop interface for defining dimension hierarchies, and it provides a single-step facility for recalculation. The program also includes built-in features for performing many tasks for which Express Server requires programming.

All this usability and convenience does not compromise Essbase's power and capability, however. While lacking a few of Oracle Express Server's capabilities, Essbase scored higher in NSTL's overall versatility evaluation. A large and growing number of third-party vendors provides a variety of analytical tools for Essbase databases, and there's an API for custom-developed applications.

Essbase's Application Manager, its administration interface, includes an outlin-

TECH FOCUS DATA STORAGE

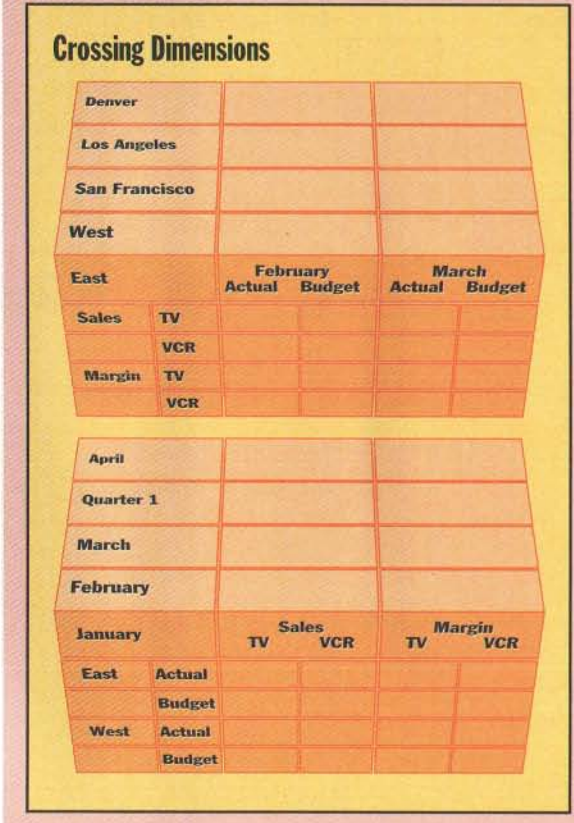
Gleaning the Cube

Large-scale OLAP products can take two distinct approaches to multidimensional data analysis. One, called relational OLAP (ROLAP), serves as a kind of middleware between client facilities and data stored in traditional relational databases. These products use SQL-based methods to access data and then convert the results into a multidimensional format at run time.

ROLAP proponents argue that this approach eliminates the need to store large amounts of data redundantly. They add that relational databases are the only way to store very large amounts of data (i.e., hundreds of gigabytes) and maintain acceptable retrieval performance.

The other approach is to store the data in a multidimensional structure, sometimes referred to as a physical cube. Richard Finkelstein, an authority on SQL databases and performance benchmarks, argues that while relational databases are well suited for OLAP, data analysis is a different process that's better served by a completely different data structure.

Some products (including Oracle Express Server) take a hybrid approach, combining storage in a multidimensional database with access to relational data. Usually this entails storing summary data in the multidimensional database, with the ability to drill down to the detailed data stored in the relational database. Storing summary data in multidimensional form reduces the need to perform run-time calculations every time an analysis is done.



Crossing Dimensions

Data cubes let you "slice and dice" your data from many different perspectives.

DIMENSIONS, MEASURES, AND HIERARCHIES

Picture a spreadsheet whose rows represent products and columns represent months; these constitute two dimensions. You can stack additional sheets (one for each sales office, say) that also have product and month rows. "Sales offices" thus becomes the third dimension.

While it's hard to visualize more than three dimensions, it's simple for a multidimensional database to have many more, representing, for example, different scenarios (e.g., budget versus actual) or customer categories. The data item to be measured across these dimensions is called a measure. In the spreadsheet example above, sales is a measure. A multidimensional database can have multiple measures. For example, you might track both monetary income and units sold across the various dimensions.

If a dimension consists of units that can be broken down into smaller units or grouped into larger ones, the relationship between unit levels is known as a hierarchy. Typical hierarchies are years broken down into quarters and months, or sales offices grouped into regions.

Many OLAP applications assign a single unit at the top hierarchical level of each dimension to represent the total for the entire dimension. Analysis tools then allow you to drill down into greater detail—for example, beginning with sales for the entire company, then by region, then by sales offices, and, finally, by individual salespersons.

er interface for defining dimension hierarchies. Users can quickly drag and drop dimension members to their appropriate positions in relation to other members. Most administrative tasks are intuitive in the on-line interface, the only serious exception being the process of matching input fields with database dimensions when importing hierarchical data.

Essbase offers architectural and structural advantages, multiuser read/write access, and cell-level locking. Dimensions can include label-only members and shared members (i.e., members occurring at multiple points within a dimension hierarchy), and measures and dimensions can include hierarchical structures. The intelligent calculator saves processing time by recalculating only those values that have changed rather than the entire database, and it does this in a single step.

Sparse dimensions are those that have a large number of empty data values. For example, a company might sell some products in domestic regions and other products in international regions. This results in a number of empty data values at various intersection points of the product and region dimensions. Essbase allows administrators to define certain dimensions as sparse, and the program optimizes storage to facilitate efficient data retrieval and minimize wasted space.

Essbase provides interfaces for both Microsoft Excel and Lotus 1-2-3, and users can update data in the database as well as read it. Essbase has convenient menu options for updating spreadsheets and for drilling down to detail-level data in relational databases. The Web gateway in Essbase is based on a small number of proprietary extensions to Hypertext Markup Language (HTML). A relatively straightforward set of embedded HTML tags adds database-access capability to standard Web forms.

Essbase doesn't support virtual measures, as Express Server does, but it supports hierarchies within measures, similar to the hierarchies within dimensions. Thus, an expenses dimension might be broken down into salaries, purchases, and so forth. Moreover, when consolidating elements at one level into the next-higher level, Essbase offers alternative consolidation methods rather than just adding the elements together. For example, you might define a profit measure, broken down into sales and cost, with profit defined as sales minus cost. This produces the same effect as an Express Server formula, except that the result of the calculation is stored in the database as a separate value.

Oracle Express Server

Oracle's OLAP entry is both new and old, a powerful analytical tool that is in most respects considerably harder to use than Essbase. Though relatively new to the desktop world, multidimensional databases have been part of mainframe computing for decades. In fact, I.R.I., the company that developed Express Server, was in business from the 1970s until Oracle purchased it in 1995.

Like Essbase, Express Server isn't so easy to learn. The beta version we tested came with little documentation for database administrators, and there is no conceptual guide describing how the server works. The manuals are lacking in how-to instructions for accomplishing tasks; most of the time you have to hunt through the alphabetical command reference.

Defining hierarchies in Oracle Express Server is somewhat cumbersome; you must specify the parent member for each individual dimension member, except for those at the top level. Express Server also allows the specification of relationships between dimensions, such as between year and month. However, the documentation doesn't clearly explain why someone would use related dimensions in some cases and hierarchies within a dimension in others.

Recalculating the database in Express Server requires rolling up each measure separately across every dimension—in other words, three measures across six dimensions means 18 roll-up operations. You can automate this type of task with a batch process, but you still have to do it yourself. For importing data from relational databases, Express Server imposes a two-step process: First, you import the spreadsheet into a temporary worksheet area, and then you copy the data from the sheet to the database.

Express Server incorporates a powerful procedural language that offers even greater flexibility than Essbase, providing you're willing to do some programming. All Express Server client tools require manual editing of configuration files to access the server. Express Server's Web gateway employs a complex programming language and requires storing procedures in the database to control database lookups and HTML formatting.

FEATURES

	Essbase	Oracle Express Server
SERVER PLATFORMS		
Windows NT	✓	✓
Unix	✓	✓
VMS		✓
OS/2	✓	
Stand-alone version for Windows 3.1/Windows 95		✓
ARCHITECTURAL FEATURES		
Multiple cubes in database		✓
Multiple databases on server	✓	✓
Sparsity management	✓	✓
Multiuser read/write	✓	
Cell-level locking	✓	
DIMENSIONS AND MEASURES		
Hierarchies within dimensions	✓	✓
Shared members	✓	
Hierarchies within measures	✓	
Multiple consolidation types	✓	✓
CALCULATIONS		
Virtual calculations		✓
Temporary measures		✓
Recalculate entire database	✓	✓
Calculate only changed values	✓	
Calculate only specified range	✓	✓
Roll up higher dimension levels	✓	✓
Roll up higher measure levels	✓	*
DATA ANALYSIS		
Reference other measures in formulas	✓	✓
Reference other levels within dimensions	✓	✓
If...else logic in formulas	✓	✓
Forecasting functions		✓
Statistical, financial functions	✓	✓
Time lag/lead	✓	✓
Moving range aggregates		✓
Detect and alert	Third-party	
Currency conversion	✓	
EXTERNAL DATA SUPPORT		
ODBC support	✓	✓
Direct database access		✓
Import text files, spreadsheets, aliases	✓	✓
Import dimension members, hierarchies	✓	✓
Multidimensional view of SQL data	✓	✓
Drill down to SQL data	✓	✓
SECURITY		
Password access	✓	✓
User groups	✓	
Database- and cell-level access control	✓	✓
SPREADSHEET INTERFACE		
Microsoft Excel	✓	5.0 only
Lotus 1-2-3	✓	
Multiple measures	✓	✓
Drill down/up, pivot, select/sort	✓	✓
Pivot	✓	✓
Select/sort	✓	✓
Update data	✓	
CLIENT-SIDE FACILITIES		
API	✓	✓
Web gateway	✓	✓
Visual programming facility	Third-party	Separate product

✓=yes; *=comparable results can be achieved using formulas.

Express Server provides convenient facilities for defining virtual measures based on calculation formulas. Rather than importing relational data into the multidimensional database and storing it permanently, users define a formula that executes SQL commands at run time.

This is essentially the approach of relational OLAP (ROLAP) databases, and it allows Express Server to take a hybrid approach between multidimensional storage and relational lookup. Generally, Oracle advises users to store summary data in the multidimensional database and use lookup formulas to the relational database when drilling down to the detail level. Express Server also offers a more extensive set of calculation functions than Essbase, includ-

OLAP SERVERS

BEST OVERALL

Essbase 4.1

Analytic muscle that's easy to learn and use makes this program a clear choice.

Outline Editor - Mrh2:Olap:Demo:Demo
Measures Accounts (Label Only)
Profit (+)

	PRICE	TECHNOLOGY	IMPLEMENTATION	EASE OF LEARNING	EASE OF USE	USABILITY	VERSATILITY	OVERALL RATING
Essbase 4.1	$37,500 for five concurrent users; $2500 per additional user	★★★★★	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
Oracle Express Server 6.0	$3995 per concurrent user	★★★★	★★★	★★	★★	★★	★★★★	★★★

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

ing forecasting functions and moving-aggregate functions, and it makes available a wider range of client-side analysis tools.

In past versions of Oracle Express Server, administrators managed sparsity by defining *conjoint* dimensions, which are essentially joins of two dimensions. The conjoint is treated as a single dimension for storage-and-retrieval purposes. One might define a conjoint of product and region to deal with different products sold in different regions and thus eliminate the empty storage areas. With version 6.0, Express Server has introduced sparsity management that's similar to Essbase's.

Oracle Express Server has two main interfaces for presenting data to the user. A spreadsheet interface allows Microsoft Excel users to retrieve and display data from their databases. However, Oracle Express Server's Windows client is only 16-bit and, while it has the ability to run on Windows 95, it will not work with Excel 7.0.

In addition to the spreadsheet interface, Oracle Express Server includes Express Analyzer, which enables users to create *briefings*—tabular and graphical displays of data, annotated with formatted text. Oracle offers several specialized analysis packages at extra cost, as well as Express Objects, a development environment for creating applications visually.

A Yes for Essbase

Both Essbase and Oracle Express Server are powerful products, offering extensive feature sets likely to meet the functional requirements of any business needing to perform multidimensional analysis on large volumes of data. The difference comes down to how easy it is to deploy each product, to get the data from its original source into a sensible multidimensional structure, and to begin performing meaningful analysis of that data without a steep learning curve or complex implementation.

From this standpoint, Essbase is clearly superior. Without sacrificing capability at all, it provides intuitive interfaces and straightforward procedures to accomplish tasks that often require convoluted programming or multiple-step procedures in Oracle Express Server. **B**

Mark Hettler has spent the last six years working at NSTL, where he pioneered its testing of SQL servers and multiuser databases. He is the author of a special NSTL report, SQL Server Performance: Tips and Traps. *You can reach him at* **mark.hettler@nstl.com.**

Evaluations in this report represent the judgment of BYTE editors, based in part on extensive tests conducted by NSTL, Inc., as documented in a recent issue of its monthly Software Digest. *To purchase a copy of that report, with NSTL's own evaluations and data, contact NSTL at 625 Ridge Pike, Conshohocken, PA 19428; (610) 941-9600; fax (610) 941-9950; on the Internet, editors@nstl.com. For a subscription, call (800) 257-9402. BYTE magazine and NSTL are both operating units of The McGraw-Hill Companies, Inc.*

PRODUCT INFORMATION

Essbase 4.1
$37,500 for five concurrent users; $2500 per additional user (requires 32 MB of RAM; 30 MB of disk space; and Windows NT, OS/2, Solaris, HP/UX, or OS/400)

Arbor Software Corp.
Sunnyvale, CA
(408) 727-5800
fax: (408) 727-7140
http://www.arborsoft.com
Circle 976 on Inquiry Card.

Oracle Express Server 6.0
$3995 per concurrent user (requires 32 MB of RAM, 20 MB of disk space, and Windows NT 3.51 or 4.0 or Unix)

Oracle Corp.
OLAP Products Division
Waltham, MA
(617) 768-5600
http://www.oracle.com/products/olap/html/
Circle 977 on Inquiry Card.

Picking Data from the Warehouse

Analysts often associate OLAP with data warehouses, those large repositories in which businesses collect data for an entire enterprise (which may include historical data spanning a number of years for all of a company's divisions). For day-to-day operations, a business needs only relatively current data, and each operating unit needs only its own data.

But large-scale analysis, for which OLAP is designed, generally needs a historical record over time, encompassing all of a company's operating units and product lines for comparison purposes. So, even though OLAP need not imply large databases—the multidimensional analysis produced by OLAP products can be useful for small businesses as well—in practice, businesses often consider OLAP as part of their data-warehousing strategy.

However, OLAP analysis generally requires summary data, not a complete duplication of the warehouse-detail data. For example, if a customer buys a certain product several times during a certain time period, the OLAP database needs only the totals, not the record of each individual transaction. Moreover, an OLAP database need not contain information irrelevant to trend analysis and forecasting, such as addresses or contacts.

So, an OLAP database normally contains only a portion of the information in the data warehouse on which it is based. Because of the way multidimensional databases structure their data, identifying information (e.g., product name, time period, and so forth) resides only in the dimension-header area (comparable to the row and column headers of a spreadsheet) rather than being repeated for each record, as in a relational database. The net effect is a multidimensional database requiring considerably less disk space than a data warehouse.

We measure high-end Power Mac clones against the original. ***By G. Armour Van Horn***

Power Macs: Cookin' at 225 MHz

APPLE POWER MACINTOSH

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★
PERFORMANCE	★★★★

MOTOROLA STARMAX 4000

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★
PERFORMANCE	★★★★

POWERTOWER PRO 225

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★
PERFORMANCE	★★★★★

UMAX SUPERMAC S900

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★
PERFORMANCE	★★★★

Better late than never. Apple's encouraging of Power Mac clones has spawned a small but growing number of systems that compete against Apple's own Power Macs with lower pricing or stronger performance. Now the Macintosh community need no longer envy the Wintel market's price competition and commodity horsepower.

By maintaining control of both the operating system and the hardware platform, Apple protects the reliability and ease of integration central to "the Macintosh advantage." As a result, Mac clones have proved truly compatible with the Apple-branded product.

In the case of Power Computing, UMAX, and DayStar, Apple provided the Tsunami motherboard design. Working closely with Motorola, Apple developed the new Tanzania motherboard design used in Motorola's new StarMax systems and expected soon in Apple machines. Cooperation with DayStar Digital led to the multiprocessor (MP) support in hardware and software used in DayStar's Genesis systems (see "DayStar Goes Quad" on page 136), Apple's Power Mac 9500/180MP, and other MP clones.

Each clone vendor seems to have a different niche. Power Computing, the first to enter the clone market, designs basic systems that push the speed envelope and are configured from a menu of options. UMAX takes a higher road (though without higher prices) and offers more elaborate support choices and an optional second processor. Motorola keeps to its strength in volume manufacturing with solid engineering and aggressive pricing on a very short list of models.

Macintosh clones are built under license from Apple, and normally in close cooperation with Apple; all boot up some version of the Mac OS. They may require a "system enabler" to accomplish this, as even some Apple models (particularly laptops) do. Mac clones connect with standard Macintosh peripherals, including keyboards, mice, storage devices, and monitors.

Like the Power Mac 9500, all the units we tested are minitowers with PCI expansion slots, and except for the Motorola StarMax 4000, all require a PCI graphics display card. Also, all have an internal fast SCSI-2 connector, again except for Motorola's StarMax. As you would expect from a Mac, all have ADB ports, RS-232/422 serial ports, parallel port, external SCSI, and audio ports.

We asked Apple and the major cloners to provide us with their fastest single-CPU 604e system, either at 200 or 225 MHz. We used BYTEmark to confirm what earlier testing had shown—that the PowerPC 604e processor is well ahead of the current 200-MHz Pentium Pros. We used Adobe Photoshop to compare performance between systems.

continued

PHOTOGRAPHS: BRIAN WILDER © 1997

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

Apple's Power Mac 9500/200

ADVANTAGES:

- + Known compatibility

DISADVANTAGES:

- – Expensive for 200-MHz system
- – Short on drive bays

Apple's fastest single-processor Power Mac is the obvious reference point for comparing single-processor Mac clones. The Tsunami motherboard handles a range of processor speeds, so little has changed inside since Apple introduced the first 9500 at 120 MHz. Apple has designed some very clever and convenient cases, but the 9500 is decidedly not one of them, although it's not difficult to deal with like the 8500. Apple's largest case is very close in size to the other minitowers in this comparison but has fewer drive bays than most.

The 9500 has the Apple name going for it, and its 768-MB maximum memory capacity is impressive, but it doesn't push the performance limits of the CPU or the system bus. And now that the Mac clones have demonstrated their reliability, the 9500 is no longer the de facto platform for image editing. While the 9500/200's Photoshop performance is faster than any single-processor Wintel machine, it isn't the fastest Power Mac. Still, Apple remains the conservative choice.

Motorola's StarMax 4000

ADVANTAGES:

- + Best bang for the buck
- + Five-year warranty

DISADVANTAGES:

- – Biggest departure from Mac standard
- – Limited memory expansion

The StarMax minitower vies with those of the best PC clones in its assembly details. Motorola made some cost compromises, such as soldering down the CPU and not building in Ethernet, but the company uses the latest Power Mac motherboard design (Tanzania). It's also the only review system to use 3.3-V dual in-line memory modules (DIMMs) for system memory. The power-efficient 3.3-V parts are more expensive today (by about 25 percent) than 5-V DIMMs, but that will change.

The StarMax system board slides out without tools, making it easy to access RAM or the PCI slots. I like my Macs with Ethernet, but leaving it out means you don't have to pay for a 10-Mbps interface if what you really want is Fast Ethernet. Lack of interleaved memory is a more serious issue as it constricts the effective memory pipeline to half its potential 128-bit width.

Like Wintel systems, the StarMax comes with an Enhanced IDE (EIDE) hard drive and AT attachment packet interface (ATAPI) CD-ROM drive rather than SCSI. EIDE drives are somewhat less expensive than SCSI drives, but they can provide similar performance. I found the StarMax drives essentially as quick as the drives in the other systems.

Power's PowerTower Pro 225

ADVANTAGES:

- + Strong performance
- + Extensive software bundle

DISADVANTAGES:

- – Awkward case below par
- – High price

While Power Computing's minitower system doesn't have the fit and finish apparent in the other entrants, it packs the most raw power with its 225-MHz 604e CPU, 1-MB L2 cache, 8-MB PCI graphics card, and 7200-rpm 2-GB hard drive. It was the fastest in the Photoshop tests. Adding to its performance advan-

DayStar Goes Quad

If one or two PowerPC 604e CPUs don't run Photoshop fast enough for you, DayStar Digital's Genesis MP800+ gives you four. Four CPUs don't give four times the performance, but the gain can be significant. Testing with several Photoshop filter operations, I measured speed-ups ranging from 23 to 183 percent over single-processor operation.

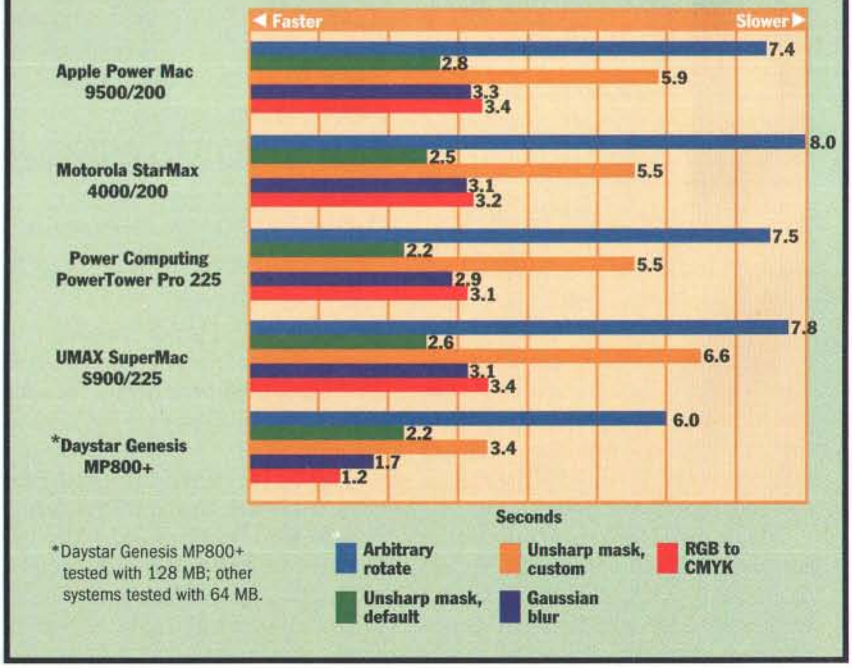
DayStar developed the nPower multiprocessing extension to the Mac OS now used by other vendors, including Apple (see "The Mac Goes Multiprocessor," February BYTE). It's not symmetric multiprocessing, though: One processor acts as master and distributes tasks to the others. To see a benefit from multiple PowerPCs, an application must use the nPower API.

I tested a Genesis MP800+ with four 200-MHz 604e chips and 128 MB of RAM. It holds up to 1500 MB of system RAM. DayStar sells the MP800+ without memory, hard drive, or keyboard for $9999. At current memory prices, you can get our test configuration (128-MB RAM, 2-GB hard drive, keyboard, and 4-MB graphics card) for around $12,000.

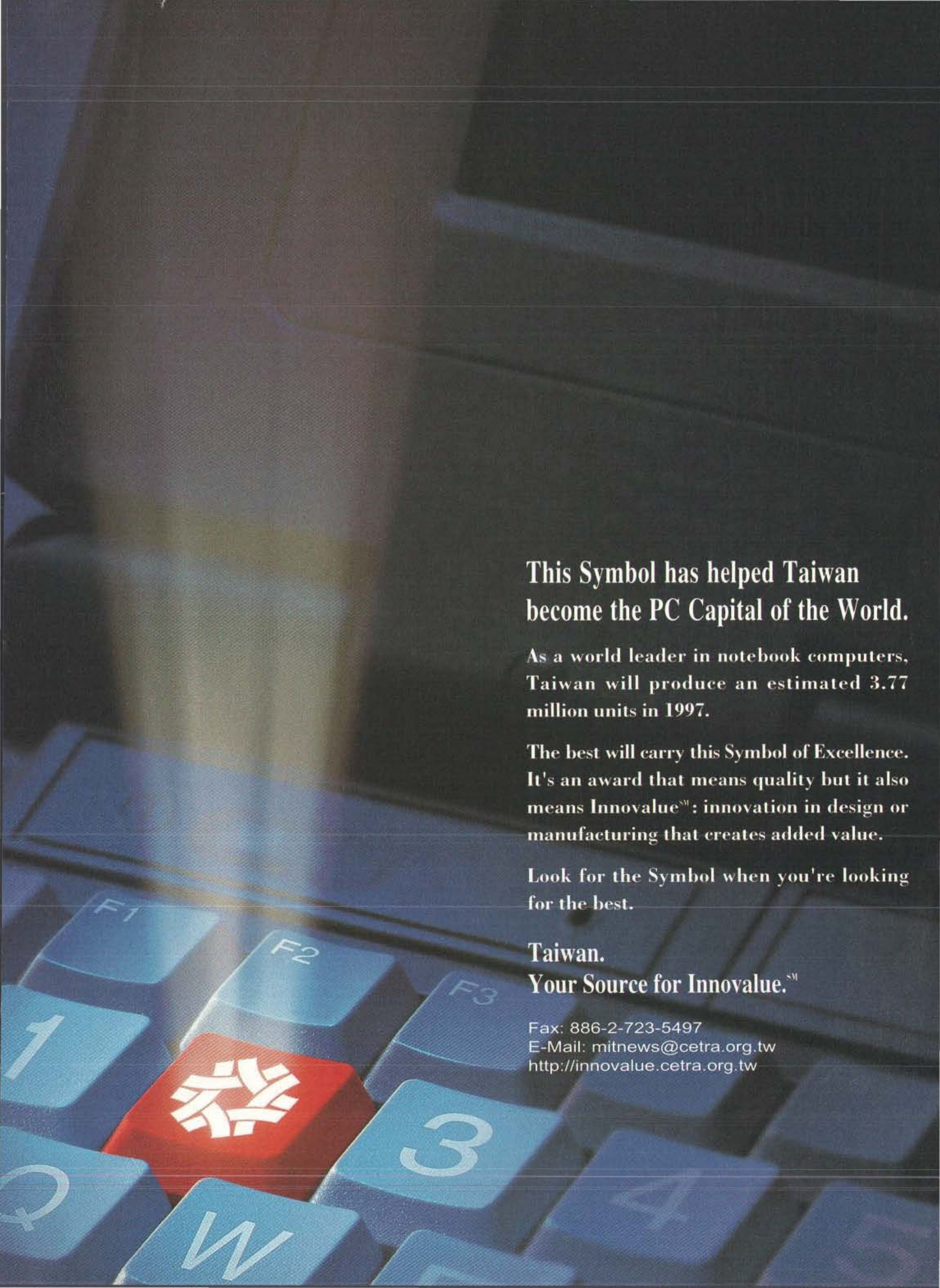
WHERE TO FIND

DayStar Digital
Flowery Branch, GA
(770) 967-2077
http://www.daystar.com/
Circle 1048 on Inquiry Card.

Photoshop Test Results



*Daystar Genesis MP800+ tested with 128 MB; other systems tested with 64 MB.



This Symbol has helped Taiwan become the PC Capital of the World.

As a world leader in notebook computers, Taiwan will produce an estimated 3.77 million units in 1997.

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tage, the PowerTower Pro has the biggest and best software bundle, which includes Microsoft Office 4.2.1. This system also has the highest price.

The PowerTower case provides the most internal drive expansion with eight drive bays. However, it's also the most difficult system to upgrade because a drive bay blocks access to the memory slots. The test unit I received had no video on startup because its IMS TwinTurbo 128 video card had become unseated in its PCI slot. That this happened at all is not a sign of top-notch manufacturing quality control.

TECH FOCUS MOTHERBOARDS

Clock Trade-Offs

Using Apple motherboard designs with Power Mac ASICs helps guarantee Mac clone compatibility. Most of our test units use Apple's Tsunami motherboard design. It's the only design that allows multiprocessing, but its memory bus operates at lower clock speeds than current Wintel motherboards. Apple's 9500/200 operates its 200-MHz 604e CPU with a clock multiplier of 4 on a 50-MHz memory bus. Although memory vendor and accelerator maker Newer Technologies asserts that the Tsunami bus was designed to run at 60 MHz, Apple has not authorized any systems running over 50 MHz.

Power Computing and UMAX run the 225-MHz 604e chip with a clock multiplier of 5 on a 45-MHz bus. This means that the 11 percent speed increase of the 225-MHz CPU (over a 200-MHz 604e) can be largely offset by the 10 percent speed slowdown on the memory bus. To benefit from the faster CPU, a program must stay off the bus, working largely in the cache.

UMAX's SuperMac S900

ADVANTAGES:

- + Low price for 225-MHz machine
- + Cost-effective MP upgrade
- + Best PCI implementation

DISADVANTAGES:

- − Cosmetic door must go

The UMAX SuperMac S900 has base specifications nearly identical to the PowerTower Pro 225. The UMAX unit has half the L2 cache, and less bundled software, but its price is also much lower than that of the PowerTower Pro 225. The handsome SuperMac minitower upholds the industrial-design look of the Macintosh, although the basic box isn't much more exciting than the other clones. A design problem: A hinged cover hides the floppy disk and CD-ROM drives, and the CD-ROM tray pops out on shutdown, swinging the door open.

The S900 offers two unique upgrade options. First, you can add a second processor card (in its own slot) without removing the original processor. Competing systems (Apple and Power Computing) require that you replace the single-processor card. Second, UMAX offers its E100 upgrade, a PCI card with both E100 Ultra Wide SCSI-3 and 100Base-T Fast Ethernet. To better support PCI-based multimedia peripherals, the S900's version of the Tsunami design uses a PCI-to-PCI bridge so that PCI devices can communicate directly with each other.

Power Mac Features

	Apple Power Macintosh 9500/200	Motorola StarMax 4000/200 Minitower	Power Computing PowerTower Pro 225	UMAX SuperMac S900/225
Price as configured *	$4449	$3344 **	$5935	$4295
Processor	200-MHz 604e	200-MHz 604e	225-MHz 604e	225-MHz 604e
Processor bus speed	50 MHz	40 MHz	45 MHz	45 MHz
L2 cache	512 KB	512 KB	1024 KB	512 KB
System memory (as priced/maximum, MB)	32/768	32/160	32/1024	32/1024
Memory architecture	Interleaved	Noninterleaved	Interleaved	Interleaved
Graphics	ATI 2-MB PCI card	Integrated 2-MB DRAM SVGA	IMS TwinTurbo 8-MB card	IMS TwinTurbo 8-MB card
Hard drive	2-GB 5400-rpm IBM DORS-32160 SCSI	2.5-GB 4500-rpm Quantum Sirocco EIDE	2-GB 7200-rpm IBM DFH552F SCSI	2.1-GB 7200-rpm Micropolis 4221 SCSI
CD-ROM drive	8x SCSI	8x ATAPI	8x SCSI	8x SCSI
Expansion slots	6 PCI	5 PCI	6 PCI	6 PCI
Ethernet	AAUI, 10Base-T	Optional **	AAUI, 10Base-T	AAUI, 10Base-T
Mac OS version	System 7.5.5	System 7.5.3	System 7.5.3L	System 7.5.5
Limited warranty, parts, and labor	1 year	5 years	1 year	1 year
Company information	Apple Computer Cupertino, CA (800) 776-2333 (408) 996-1010 http://www.apple.com/ Circle 1047 on Inquiry Card.	Motorola Computer Group Tempe, AZ (800) 759-1107 (512) 434-1526 http://www.mot.com/computer/ Circle 1049 on Inquiry Card.	Power Computing Round Rock, TX (800) 370-7693 (512) 246-7807 http://www.powercc.com/ Circle 1050 on Inquiry Card.	UMAX Computer Fremont, CA (800) 232-8629 (510) 226-6886 http://www.supermac.com/ Circle 1051 on Inquiry Card.

* Prices do not include monitor.

** Motorola configuration price includes Asante Ethernet card.

Best Bet

I found all the systems delightfully responsive and, after paring down some long INIT lists, quite stable. Based on application performance, Power Computing's PowerTower Pro 225 comes out ahead with its 225-MHz CPU and 1-MB L2 cache. UMAX's 225-MHz SuperMac S900, however, did not perform any faster than Apple's 200-MHz 9500/200, perhaps due to its 45-MHz memory bus (see the Tech Focus). The PowerTower Pro also has a 45-MHz memory bus but may have been saved by its double-size L2 cache. The 200-MHz Motorola StarMax ran slightly faster than the Apple system, most likely due to the new Tanzania motherboard design.

The PowerTower's performance advantage is too small to justify its higher price. The spartan StarMax's good price/performance ratio is offset by its upgrade limitations. That leaves the elegant and well-supported 225-MHz UMAX as the system of choice. It provides similar performance to the 200-MHz Apple, but it costs a few hundred less and has excellent high-end performance options. **B**

Note: *At press time we learned that Apple dropped the 9500/200's price by $1000 to $3449. It was too late to determine how the other vendors in this review will react with their own pricing.*

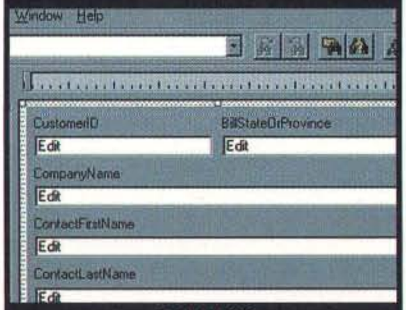
G. Armour Van Horn is a production artist and consultant in electronic imaging and prepress. You can reach him at **vanhorn@whidbey.net.**

The latest C++ development environments do rapid application development to simplify business database applications. ***By Rick Grehan***

Client/Server C++: Write Fast, Run Fast

Stand back for the new breed of client/server development systems. These aren't the familiar fourth-generation language (4GL)–based integrated development environments (IDEs) with unwieldy run-times that your applications must lug around like backpacks. Quite the contrary: These new development systems, from Blue Sky, Microsoft, and Powersoft, are C++-based, ushering that language into a product market heretofore occupied only by the likes of PowerBuilder and Delphi.

VISUAL SQL



RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★

Microsoft's entry, Visual C++ Enterprise Edition 4.2 (VC++EE), includes the ubiquitous VC++ foundation, which is topped with features aimed squarely at assisting in the construction of database applications. Blue Sky's Visual SQL 4.01 (VSQL) is an interesting attempt at symbiosis with VC++EE, providing what amounts to add-on tools and wizards to VC++EE that steer VC++ even further into the database lane. Finally, Powersoft's Optima++ Enterprise Edition 1.5 is its own interesting mixture of raw C++ programming power and database connectivity.

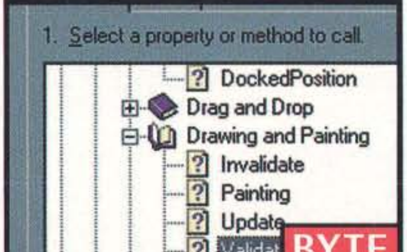
A note of clarification: To say that an application is a "client/server" application *should* speak only of its architecture—that the application has been partitioned into client and server portions. Not so here; when I say client/server, I mean *database* client/server—database applications with a GUI client and a database engine server. (Consequently, these are two-tiered client/server systems.) Business logic typically lives on the client, although stored procedures and triggers on the server can manage much of the database-intensive business computing.

After spending more than a week using all three tools, I have concluded that Powersoft's Optima++ is the most useful, especially if you haven't already settled on another product for your client/server development. Optima++ strikes the best balance between wizardly handholding and on-the-metal programming. The product also makes it easier to reverse-engineer the code it automatically writes.

Common Denominators

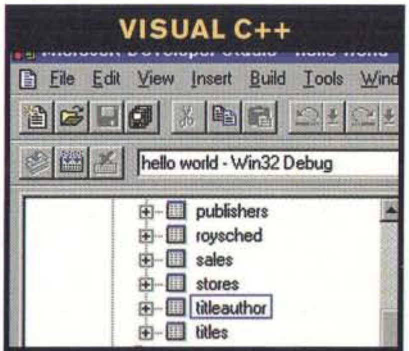
The deliverable produced by all three products is a client/server database application written in C++, but I'm taking liberties in pigeonholing these tools that way. For example, although VC++EE's features lean heavily toward database application construction, the system is by no means limited to this. After all, VC++EE has at its heart a complete C++ development system. Similarly, Optima++'s core is the Watcom C++ compiler, and there's absolutely no reason why you couldn't use Optima++ to build non-client/server programs that have nothing to do with databases.

OPTIMA++



RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★★

VISUAL C++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RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★

VC++ already has substantial support for client-side construction, so the Enterprise Edition shifts its focus to server-side tools. It performs this shift by incorporating tools for editing and debugging a database's stored procedures from within the IDE. Meanwhile, Optima++ concentrates its attention on the GUI (i.e., client) side of an application with the aid of a clever RAD technology that's a help system crossbred with a code generator. And VSQL presents you with a roomful of wizards that carry you through the process of building the more-typical database applications (e.g., master/detail update screens) and does so while shielding you, as much as possible, from the underlying C++ code. It's like three climbers assaulting the same mountain along different trails; they all hope to arrive at the same peak.

continued

Visual C++ Enterprise Edition

ADVANTAGES:

+ Integrated editing and debugging of stored procedures and triggers.
+ DataView pane provides quick viewing of database structures.

DISADVANTAGE:

- SQL editing/debugging currently works only with SQL Server 6.5.

VC++EE amounts to the Professional Edition of VC++ plus several accoutrements useful in building database applications. Specifically, it adds SQL editing and debugging to the VC++ IDE. Also, the DataView pane—available in the project workspace—provides management functions and access into any databases you include in your project workspace.

Some warnings up front: If you want to have the VC++ IDE and SQL Server on a single machine, Windows 95 won't work (SQL Server 6.5, bundled with VC++EE, runs on NT). And even though the CD-ROMs include a patch for NT 3.51 to bring it up to snuff, I ran into numerous difficulties trying to get it to work. Microsoft recommended I upgrade to NT 4.0, which I did. That worked.

SQL editing and debugging are well integrated into the VC++EE environment. Open a new project and put a data source into your workspace, and a DataView tab appears in the left window. Open the DataView pane, and you have expanding outline-style access to the data source's stored procedures, tables, user-defined data types, and views.

For most database entities, the DataView pane provides read-only access; you can look at property-field types, table structures, and so forth, but you cannot modify them. You can, for example, dump a table or a table view—in which case the output appears in the results window—but you can't update data within the table. As of this writing, the DataView pane worked only with Oracle and Microsoft SQL Server data sources; the SQL debugging feature was usable only with SQL Server 6.5. Other data sources might be added in the future.

You can, however, insert stored procedures into a database and add triggers to a table. You can then execute the stored procedure through the debugger, set watches and breakpoints, and generally interact with the stored procedure much as you'd interact with a C++ program.

Other elements in VC++EE have been in the VC++ package for some time: the AppWizard, the ClassWizard, and the Component Gallery. VC++ 4.2 (the heart of the Enterprise Edition) adds support for remote data objects (RDOs) in the form of a remote data control in the component gallery, and visual data controls that can be bound to the remote data control. VC++ also extends Microsoft Foundation Classes (MFC) support of open database connectivity (ODBC), adding features such as multithreading within ODBC classes.

continued

TECH FOCUS DATABASES

Database Alphabet Soup

DAO? Jet? ODBC? RDOs? How do these terms all fit together? Do the technologies they represent compete with or complement each other? It's easy to get lost. Below is a simple road map to help you out.

DAO (data access objects) is an API that's based on OLE and is included in MFC (Microsoft Foundation Classes) version 4.0. DAO uses Jet, through which DAO components can access ODBC data sources, as well as indexed sequential-access-method (ISAM) databases (e.g., Paradox and Btrieve).

Jet is the database engine that Microsoft introduced with Access. The native file format understood by Jet is the Access (MDB) file format, although Jet can access ODBC data sources.

ODBC (Open Database Connectivity) is the "lowest common denominator" interface into a database. ODBC drivers exist for virtually every database back end known to humanity; there are even drivers for data in raw text or Excel spreadsheet files.

RDOs (remote data objects) appeared with Visual Basic 4.0 (which is now available in VC++) and provide a thin layer atop ODBC. RDOs' raison d'être was to expose database processing on the server side (processing that DAO so masked that most of its database processing takes place on the client side). RDOs are optimized to work with back-end query engines provided by, for example, Microsoft SQL Server.

FEATURES

	Optima++ Enterprise Edition	Visual C++ Enterprise Edition	Visual SQL
Description	A C++ IDE with unique automated programming ("reference card") and database-connectivity features.	Visual C++ with the DataView pane and SQL editing and debugging.	A collection of wizards and components that enhance Visual C++ with client/server database capabilities.
Wizards	Form Wizard jump-starts a variety of application styles; Query Editor automates construction of SQL queries.	AppWizard, Custom AppWizard, OLE Control Wizard, ClassWizard.	More than you can count: Includes VSQL AppWizard, Data Screen Wizard, Datasheet Wizard, Fill Datasheet Wizard, SQL Wizards, SQL Editor, SQL Query Builder.
Other products bundled	Sybase SQL Anywhere, Intersolve DataDirect ODBC Drivers, DataWindow Builder, Installshield, ObjectCycle, InfoMaker.	SQL Server 6.5, Visual SourceSafe, InstallShield, Crystal Reports.	Sybase SQL Anywhere, Database Explorer, Graphics Locator.
We're glad it...	...uses reference cards. They provide just the right amount of help, keeping track of objects and methods without causing you to lose your grip on the code.	...allows debugging of SQL in triggers and stored procedures. This works seamlessly with debugging of the primary application.	...includes such capable wizards. They save typing miles of C++ code to generate database applications of C++ code to generate database applications.
We wish it...	...provided some way to integrate the DataWindow into Optima++-generated applicatons.	...would widen its SQL debugging and editing to more data sources.	...extended its database support beyond ODBC.

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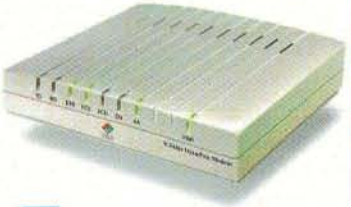

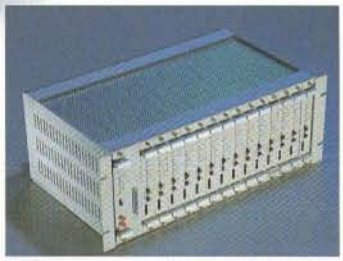

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Visual SQL

ADVANTAGES:

+ Lots of Wizards; very helpful for novices.

DISADVANTAGES:

- Requires purchase of VC++EE.
- Abundance of wizards could be annoying for skilled programmers.

VSQL is actually an adjunct to VC++, providing tools and wizards missing from the VC++ platform. Indeed, to install VSQL you must first install a copy of VC++ (version 4.0 or higher). Ironically, Blue Sky recommends you use VC++EE.

Install VSQL, and you insert a slew of wizards and design-time components into your VC++ environment. Some of these wizards are application builders—the Client/Server AppWizard, for example. Others assist you in assembling pieces of the application; for instance, the Datasheet Wizard helps you build a datasheet dialog box, which works well as the detail side of a master/detail application. Still other wizards are stand-alone tools, such as the SQL Query Builder, with which you can visually build a SQL statement by pointing and clicking on buttons. (Experienced users may find this simplistic, however.)

VSQL floats on a layer of MFC, which in turn floats atop ODBC. VSQL adds a set of classes to MFC that extend ODBC support. In this sense, VSQL is a VC++ equivalent to Visual Basic add-in products.

Wizards are so important to VSQL that it makes sense to describe some of them in more detail. Some explanations follow.

Client/Server AppWizard. A database-focused, pumped-up variation of the standard AppWizard, this is where you construct muscular database applications. For example, the C/S AppWizard can guide you through erecting a feature-rich master-detail database application.

Data Screen Wizard. This leads you through the design of a data screen, which is a window into a record fetched from a table or a view. Occasional side trips occur into the Query Builder, where you build the query that fetches the requisite record.

Datasheet Wizard. Similar in operation to the Data Screen Wizard, this helps you design datasheets, which are spreadsheet-style variants of data screens.

Other wizards include the Fill Datasheet Wizard, which you use to determine what data will go into a datasheet—a query, a view, or a whole table. Should you select query, the Fill Datasheet Wizard sends you into a nest of builders and SQL wizards: Select Query Wizard, Insert Statement Wizard, Update Statement Wizard, the aforementioned SQL Query Builder, and more. There are so many wizards, editors, and builders assaulting you with assistance that it's easy to lose your way.

Finally, two welcome members of the VSQL tool set are the configuration tester and the ODBC data-source tester. The former allows you to verify that you set things up properly when you installed VSQL—something I'm never sure of until it's too late. The latter verifies that an ODBC data source is correctly configured.

Optima++ Enterprise Edition

ADVANTAGES:

+ C++ programmers have better control over generated code.
+ Lots of bundled packages.

DISADVANTAGE:

- Not recommended for novice C++ programmers.

Optima++ (see the review "A C++ Tool That Cures VB Envy," October 1996 BYTE) comes from a company that's the offspring of a series of mergers among Watcom, Powersoft, and Sybase. This ancestry is obvious in Optima++: A core C++ compiler, the DataWindow Builder, and Sybase SQL Anywhere all come bundled in the Optima++ Enterprise product.

Optima++ emphasizes the GUI side of the development process. Still, rather than attempt to hide the intricacies of the generated C++ code, Optima++ keeps the source in your face even as it's generated. While some developers might prefer the VSQL approach, Optima++ engineers boast that the developer always has a clear shot at the C++ code.

Optima++ uses the familiar form-based drag-and-drop construction of applications, along with the expected object-properties window, but it marches to its own drummer in the way it provides programmer assistance during application construction. Optima++ uses what Powersoft calls the "reference card," a sort of active help system that provides instant access to the source code prototype of an object's methods. (Not that Optima++ has no wizards—it includes a Form Wizard that's similar to the VC++ AppWizard.)

The reference card uses drag-and-drop programming to associate an object with its actions. Drag an object from the form and drop it into a source code window, and a reference card appears. From within the card, select an object's method (click on the help button if you forget its precise function), and Optima++ pours the call to the method into your source code.

Optima++ Enterprise Edition also includes a legacy of Optima's PowerBuilder roots, the DataWindow. This is a kind of customizable database-access and management tool.

To the Enterprise

Which product should you buy? That depends not only on which side of the client/server line your development emphasis lies but also on what tools you currently use. If you already have a copy of VC++ and you're wrestling with server-side triggers and stored procedures, upgrade to the Enterprise Edition. Consider also investing in Blue Sky's VSQL to help you quickly bang out database-access applications.

If you have no client/server development tools in-house, Powersoft's Optima++ Enterprise Edition sits atop a solid C++ compiler, comes with more accessories than you'll ever need, and—if Powersoft and Watcom maintain their track records—will only improve with time. **B**

Rick Grehan is a senior technical editor for BYTE reviews. You can reach him by sending e-mail to **rick_g@bix.com**.

PRODUCT INFORMATION

Optima++ Enterprise Edition 1.5
$1999
Powersoft
Concord, MA
(800) 395-3525
(508) 287-1500
sales@powersoft.com
http://www.powersoft.com
Circle 1044
on Inquiry Card.

Visual C++ Enterprise Edition 4.2
$999
(requires Windows 95 or NT)
Microsoft Corp.
Redmond, WA
(800) 426-9400
(206) 882-8080
http://www.microsoft.com/
Circle 1045
on Inquiry Card.

Visual SQL 4.01
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(requires Microsoft Visual C++)
Blue Sky Software Corp.
La Jolla, CA
(619) 459-6365
fax: (619) 459-6366
sales@blue-sky.com
http://www.blue-sky.com
Circle 1046
on Inquiry Card.

Jerry Pournelle

Chaos Manor

It Was a Great Comdex

Here are a few of the things that impressed Jerry this year—and a few caveats.

Three things happened this month, all related. First, the biggest and busiest Comdex ever took place. Over 200,000 people, thousands of exhibits, tens of thousands of products; and the BYTE editors have to look at every one of them, because we decide the winners of BYTE's Best of Comdex awards. You can find out about the winners on BYTE's Web site.

Of course, we can't possibly see everything, but we do try, and it's astonishing how much we get to. It remains true that the session in which we pick the awards is the most information-rich meeting I regularly attend, rivaled only by meetings of the Citizens Advisory Council on National Space Policy. It also lasts all night after three days of rushing around trying to look at everything.

This brings us to the second event: I got a severe case of bronchitis and strep throat. I was coming down with it when I gave out the Best of Show Award. Although I think my speech was OK, the bugs I was carrying left me confused enough that I almost forgot to introduce the Show Director of Comdex, who actually presents the Best of Show Award. Shortly after the ceremony, I was near collapse. If Roberta hadn't been in Las Vegas with me, I'd never have gotten home.

That links with the third event. Before going to Comdex, I'd started a fire-and-sword purge, throwing out (actually donating to the University of California Institute for Global Cooperation) about 20 boxes of accumulated stuff and boxing up a lot more, thus getting it out of the way for later sorting; but when I got back, I wasn't able to deal with the boxed material.

The result is more chaos than usual at Chaos Manor, but it was a great Comdex.

In my judgment, the most significant thing at Comdex was Play, Inc.'s (Rancho Cordova, CA, http://www.play.com/) Trinity. The technical team at Play includes many of the Amiga developers. Trinity is the Video Toaster on steroids: it's a $10,000 box that does video mixing and editing effects you couldn't have done a year ago without a million dollars' worth of equipment. Trinity will revolutionize the video-editing business. Almost anyone can create video effects that only big studios could do not long ago. The deservedly popular science fiction series *Babylon 5* was made possible by software developed by NewTek, which also designed the Video Toaster. It will be fascinating to see what new shows we get from Trinity.

The result is more chaos than usual at Chaos Manor, but it was a great Comdex.

More good news: Play's Snappy image grabber now has drivers that let you use it with Windows NT systems.

Trinity didn't win BYTE's Best of Show award. That went to Microsoft's (Redmond, WA, http://www.microsoft.com/office) Office 97 Suite. Our award criteria are innovation, impact on the industry, and "way cool." Office 97 Suite meets all three requirements. It is a significant improvement over its predecessor. The document-summarization feature in the Word upgrade is awesome. It produces an intelligent précis of a document, and while you can write documents that will fool the summary engine, for the most part, it does at least as good a job as a college freshman.

Of course, Corel WordPerfect Suite 7 for Windows 95 is good enough, as was the Microsoft Word 7 Suite. For that matter, on my "monk's cell" 486 where I write fiction, I'm still using Word 6.0c, although one of these days I'll upgrade. The neat thing is not only do we have choices, but almost all the rational choices are better than anything we ever expected a few years ago.

The neatest category was peripherals, with three solid finalists. Seagate's (Scotts Valley, CA, http://www.seagate.com) Cheetah 10,000-rpm hard drive won because we think it's the first of a revolutionary series of ultrafast hard drives. If you haven't noticed, hard drive space is down to $100 a gigabyte and falling while drives are getting faster and faster.

The other two finalists weren't far behind: ViewSonic's (Walnut, CA, http://www.viewsonic.com) PV140 ViewPanel, a 14-inch flat-panel color display you have to see to believe, and DeLorme's (Freeport, ME, http://www.delorme.com) Tripmate Global Positioning System (GPS) receiver and software bundle.

ViewSonic was displaying the PV140 ViewPanel on their upper deck close to really bright overhead lights, just to show off how it performed in glare conditions, and it was just wonderful. It's a bit expensive now, but it's already good enough to be the monitor for a small office/home office (SOHO) main system desktop; and prices always fall.

I now believe that in a couple of years, most of us will be able to get rid of huge monitors in favor of light flat-panel displays that can hang on walls or sit on desktops, and I can hardly wait. Incidentally, I'm still using ViewSonic monitors at several workstations, and for what I do,

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they're near perfect. ViewSonic emphasizes sharpness and resolution rather than color fidelity, which isn't to say the colors are not very good; and the sharpness and definition make it easy to stare at them all day. For price/performance, it's hard to beat ViewSonic monitors.

The final peripheral, DeLorme's Tripmate GPS receiver, is a cigarette-pack-size box that connects to your laptop. You insert the DeLorme Street Atlas USA CD-ROM, and, lo!, your computer will not only know where you are, but show you on a map as you travel. I'm due to get one of these shortly; a full report then, but if you do a lot of traveling in odd places, you may want one of these right now.

The potentially most useful thing I found at Comdex is Acceleration Software International's Superfassst. Despite the ridiculous name, this thing really works; but read the rest of this before you buy it.

I never saw Superfassst on display. As we were going through the Hilton on the way to the meeting to choose the awards, someone thrust a CD-ROM into my hand and told me to try it. "It will make your programs load faster and speed up all your disk operations," he said. I took it to the meeting, and before we discussed the Best Utility category, I installed it on my Nimantics Orion 6× laptop. Installation was simple, and when the setup was finished, there was a gaudy Christmas tree ornament on my desktop. The instructions say to drag a program to that to open it.

I chose Microsoft Word 7, and my jaw dropped. "Holy moley!" said I, and all the BYTE editors came over to see. I closed Word and did it again. It loaded in about 20 percent of the time it usually takes. I loaded a big document—the full text of my new novel *Starswarm*. It came up instantaneously.

About 1 minute later, the program was a Best Utility finalist. A data-protection program from Octopus Technologies (Yardley, PA, http://www.octopustech.com), Octopus for Windows NT, won the category, but my vote stayed with Acceleration's speedup utility.

I've since installed Superfassst on Cyrus, the Cyrix 6x86-P166. It seemed to work just fine, but next morning I found an odd error message on the screen. When I tried to shut down, I couldn't. I then spent about 2 hours installing and uninstalling the program.

Superfassst comes with an uninstallation batch file on the CD-ROM. Alas, that

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didn't work properly either: it leaves a DOS prompt window unclosed and unclosable without Ctrl-Alt-Del.

My normal inclination at this point would be to use the CD-ROM as a Frisbee, but I have to confess that I really got fond of the faster disk operations; so I spent a couple of hours fooling around with it. I haven't located all the problems, but I know about some.

The acid test will be if you can now shut down the system in a normal manner.

Before you install Superfassst, go into your Start-up folder and drag everything to a new folder named Starsave or some such. Use the right mouse button to drag and tell it to *move* the programs. In particular, be sure that System Agent and Norton System Doctor are not going to run on start-up, and it won't hurt to get rid of First Aid, too. Now shut down the system. Bring it up again, and install Superfassst on this clean system.

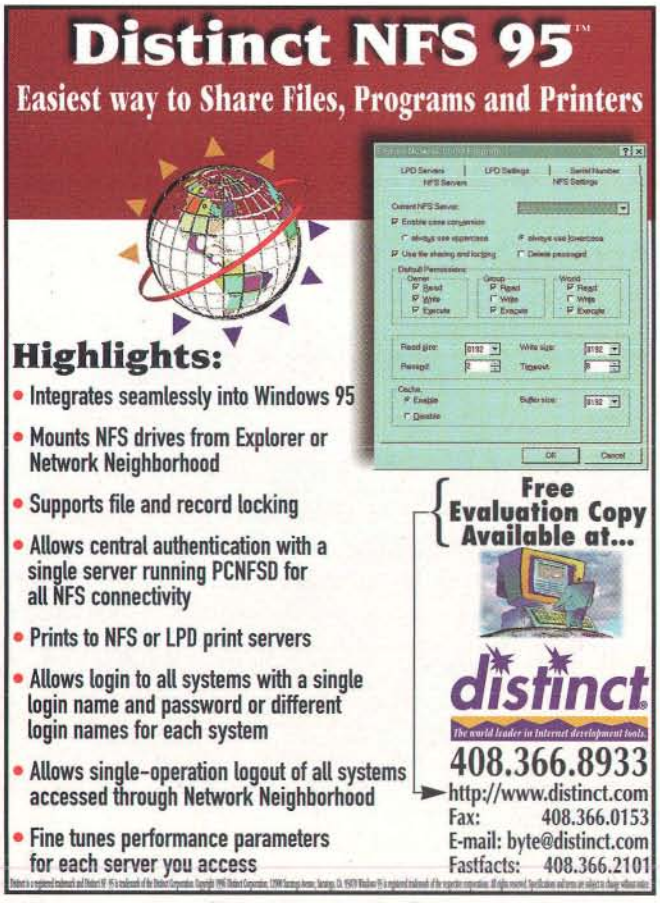
The acid test will be if you can now shut down the system in a normal manner. If you can, Bob's your uncle. If not—if the system hangs—you'll have to uninstall Superfassst and try again. Once it's installed and you have shut down properly, you can restart First Aid, System Agent, and all your other start-up programs with one exception: Norton System Doctor and Superfassst just don't get along. I don't know why.

Eventually I got the program running properly, and it now seems stable, although I have had some minor glitches. None have lost me any work. When you get it running, the results are impressive. Programs load and save much faster. Moreover, I have had no problems with any program once it's loaded with Superfassst. The problems are with Superfassst itself, which keeps dying in odd ways.

I don't know how this thing works, but it speeds up everything it touches. In particular, it works with Word 7; Q&A and Q&A Write (which reside on a network server, not locally, and which usually take forever to load because when I load them, I also load the memory-resident DefPlus dictionary and Word Finder thesaurus); DOS programs, spreadsheets, simulation programs, games. They all load much faster, and so far I haven't had any interferences at all; and shutting down Norton System Doctor seems to have fixed one major glitch. However, I have restarted System Agent and First Aid, and while I can't trace problems to them, Superfassst is giving itself fits again.

The company has part of the story on how the program works in the brochure that comes with the CD-ROM, but I don't really understand what's happening. All I know is that it speeds things up something wonderful, and when it's working properly, it's the most useful software I found at Comdex. Acceleration promises that a new version that fixes some known problems will be out before you read this. I've uninstalled the present version because it's more trouble than it's worth, but I'll try the new one when it comes out.

I really have to put Superfassst in the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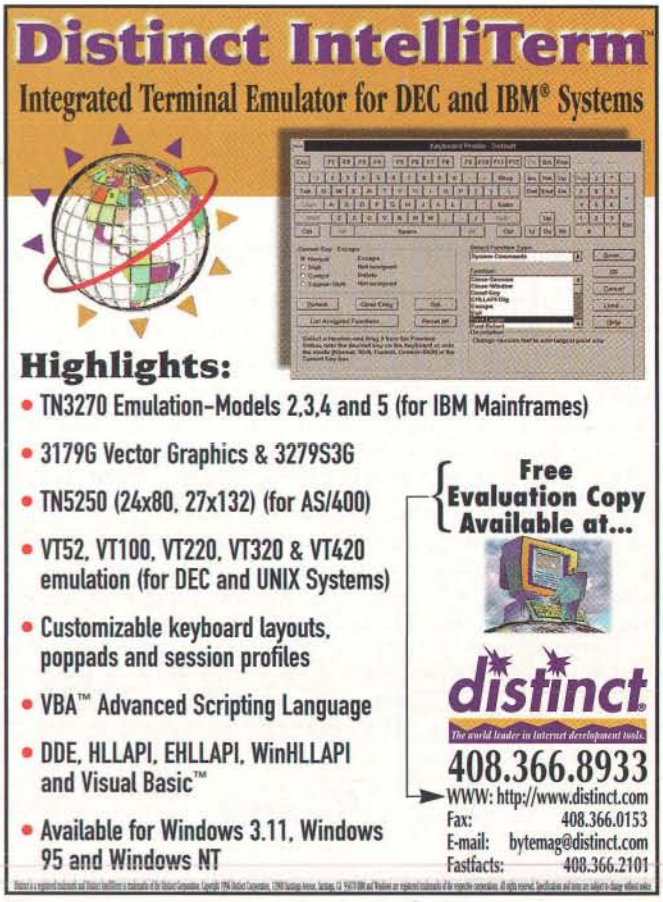
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experimental software category. I want to like it, but be warned, I've had problems, and you may also. With luck, the new version will be more stable.

I recently changed my main system from Pentafluge to Cyrus. My other choice was Racing Cow, a Gateway 2000 P5-133. (I suppose that in theory I could have reclaimed Joizy, the Gateway 2000 P5-200XL that Mrs. Pournelle uses, but the consequences of doing that were too gruesome to contemplate; Roberta *likes* that machine.)

The decision factor for me was that I need a fast Pentium system to be a test-bed for new hardware and software. You want a good standard system for that, and Racing Cow is as standard as they come. I do not use my main machine as a test-bed, so Cyrus became my personal workstation.

I am pleased to report that we now understand the hesitation problem and have a complete cure.

As soon as I got Cyrus set up and networked, the hesitations started. That is, every few minutes I can be typing away and what I type doesn't appear on-screen for about half a second. This condition lasts a couple of seconds and comes in patterns of three hesitations separated by 2-second intervals. Most of you will recall that I had this problem with Pentafluge. I thought that going to a faster machine like Cyrus would cure it.

Well, enough is enough. I am pleased to report that we now understand the hesitation problem and have found a complete cure.

First: if you're using an Intel EtherExpress 16-bit Ethernet board in a Win 95 system, you should get the latest drivers from Intel; but that will *not* cure the hesitations. Cyrus doesn't have an Intel EtherExpress board. We are using an Applied Creative Technology Ultimate PCI-3000. The hesitations aren't the board's problem.

You must go to Control Panel, Network, and look for the TCP/IP PCNET Ethernet adapter. Double-click on that, and you'll see its properties. If you're having the kind of hesitations that plagued me, you will see that it is set to "Obtain an IP address automatically." Change that to "Specify an IP address." Now, hand-enter the primary address as 192.168.0.1, check OK, and let the system reset. That will end the hesitations. That address is bogus—actually it's reserved for private nets and will never be used. What it does is prevent the software from going out to find an address it doesn't use but thinks it wants.

It didn't quite end there for me. For reasons not at all clear to me, I have two copies of the TCP/IP PCNET Ethernet adapter binding. I set the first to a bogus address as described above and eliminated the second; but when the system came back up, Win 95 said it found new hardware and installed the second copy again—and I still had hesitations. Then I went into the second copy of TCP/IP and gave it the phony IP address as above, and that did it: Cyrus no longer hesitates. One day, I may eliminate both those bindings, remove the card, bring the system up so that it thinks there

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is no Ethernet, and reinstall the Ethernet from scratch. That should get rid of the second copy of the TCP/IP binding. For the moment, though, everything works, and I don't have much incentive to "fix" it. In particular, the Ethernet works fine, and the hesitations are gone, gone, gone.

Of course, if you don't use TCP/IP for your internal connections, you can get rid of all the TCP/IP bindings to your local Ethernet card (but *not* to Dialup Networking). You may use it and not know it. Traveling Software's LapLink for Windows can use TCP/IP. It also requires a real knowledge of TCP/IP addresses; my bogus ones may not work. In general, you're safe enough deleting the TCP/IP binding to your local Ethernet card (but *not* from Dialup Networking) right now; but it's also safe to say that within a couple of years, you're going to have to understand IP addresses or find software that does. You have been warned.

I wish I could say I figured all this out myself, but in fact a reader, Theodore A. Jump of SPGS, Inc., discovered the cure and sent it to me by e-mail. He has my eternal thanks for curing one of the most persistently vexing problems I've had in the past few years.

Changing to Cyrus has done a world of good for my Internet connections. When I was using Pentafluge to connect to EarthLink, I would often get retries and hesitations, problems accessing e-mail, and other difficulties, sometimes requiring help from the EarthLink technical-support people. With Cyrus, I simply inserted the EarthLink Total Access Win 95 installation CD-ROM, let it trundle, told it I already had an account, gave my user name and password—and voilà!, all is well, and I get connected to EarthLink every time I try.

I have no real explanation. However, Pentafluge was a very early Pentium 60 and one of the first to have Win 95 (the Microsoft product manager came with a beta copy to experiment with Pentafluge long before Win 95 was released). I thought I had eliminated all traces of beta code, but now I wonder. Alternatively, there may be some BIOS problems. Whatever the explanation, switching to Cyrus has cured my Internet-access difficulties.

The Internet is still far too slow, and I have yet to find any newsgroups worth the time required to wade through the spam. I don't have time for chats, and if I want a serious discussion of computers, society, or the impact of computers on society, I have all that and more in my conferences on BIX, where nearly everything said is relevant and interesting. I still keep a couple of magazines handy when I want anything from the Internet, because I still spend a lot of time waiting for something to happen; but with the Cyrix, it's so much better now that I'm beginning to understand why some people can become fascinated with the Internet. I didn't think changing to a much faster machine would make that much difference, but it has.

If you're going to surf the Internet, you'll find it's worth it to have a fast surfing machine.

I've been trying to avoid it, but there's nothing for it: I've got to eat a healthy helping of steamed crow.

David Kaminer is an old friend. Once upon a time, he used to introduce me at my annual lecture at the West Coast Computer Faire, and we've kept in touch over the years. At Comdex, he invited me to meet Dr. Roger Billings.

Some years ago, I heard that Dr. Billings was suing Novell on the grounds that he had invented the notion of client/server systems. This seemed ridiculous on the face of it, and I said so in print. In my defense, I took my account of the case from two sources, both usually reliable, and I showed that column to several editors and colleagues. Nobody objected to what I'd said.

Alas, that's not much of a defense. I should have spoken to Dr. Billings before I shot my mouth off. Now I have, and I owe him an apology.

He doesn't claim to have invented the notion of client/server systems. He does claim to have invented and patented some methods for making client/server systems work, and that Novell used his patented technology in designing NetWare.

I haven't the competence to determine the truth of his claims. I can say that Billings' (Independence, MO, http://www.wband.com) WideBand Gigabit Networking System as shown at Comdex is amazingly fast over standard 10Base-T twisted-pair wiring. The system consists of concentrator boxes, which can be daisy chained, and boards for PCI- and ISA-bus systems. Put them together, and you get 333 Mbps going out of your desktop PC to your LAN and 666 Mbps coming in the other way. The system is easy to set up and has enough bandwidth for anything you'd care to do: video, data, voice, telemetry,

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This isn't a review of the WideBand Gigabit Networking System; my point is that clearly Dr. Billings, who began in CP/M days just as I did, has great technical expertise in data networking.

I'll have more about WideBand in the future. For the moment, herewith my public apology to Dr. Billings for making fun of his lawsuit. Whether or not his claim is sustained, it very clearly is not frivolous, and I shouldn't have said it was.

The game situation is wonderful. First, I'm pleased to report that the downloadable patch for Interplay's Conquest of the New World fixes nearly all of the outright bugs. The naval battle situation is still ridiculous: you can attack a single enemy with an entire fleet of ships of the highest quality, and not only not sink the enemy, but lose one of your galleons. Otherwise, it's an excellent strategy game. It drags a bit in the middle as you try to build up your forces before you can accomplish anything, and it's possible to win so decisively that the end game is dull, but before that happens, you will have had plenty to do.

The game of the month is SSI's Steel Panthers II: Modern Battles. This is a wonderful simulation of modern armored war, turn-based rather than real-time so you're not playing whack-a-mole, and with quite realistic capabilities of the units. The graphics are excellent. My copy has numerous bugs, none fatal, but some are very annoying. The "music" can get stuck with a gunfire passage, and the cursor often "sticks" rather than scrolling properly. I suspect that by the time you read this, there will be at least one bug patch. Problems and all, it's as good a game of modern warfare as I know of. I could use this to design and write battle scenes for novels, and by this time next year, I probably will have.

There's a patch for SSI's Age of Rifles that makes it a lot more playable, fixing the campaign scenario bug that made you change sides in the middle of a campaign. However, the real secret of playing Age of Rifles is to invoke it with the command line "Rifles reaction+." This turns on some better AI code that for some reason isn't activated by default. The result is a great deal more realistic battles.

I could use Steel Panthers II to design and write battle scenes for novels.

Fantasy General, also from SSI, remains on my list of best games of the year. It's medieval armies, with magic playing an important but not overdominant role. I sure like it. It's also one of the toughest games to win, and the computer doesn't cheat at all. If you get it, you should also get the Prima Publishing book *Secrets* by Terry Coleman. The discussion is excellent, and the tips help without spoiling the game.

The real news here, though, is that MicroProse Software's Master of Orion II is finally out. Master of Orion, better known as MOO, was the all-time best space war game ever done, still playable years after its release. I've had a copy on every machine I use— except the one in the monk's cell where I write fiction—since it came out. MOO fans have been waiting for MOO II for years.

It appears to have been worth waiting for. I say appears: we got it yesterday, and last night Alex snaffled it off. I drove him out of the house at 2:30 a.m. He hadn't paused long enough to tell me much about the game, which means I'll have to try it myself; but I'll be astonished if I don't find it a black hole for my time. Certainly MOO was. More on this one next month, assuming I can stop playing it long enough to write next month's column. I haven't seen a strategy book, but I'm sure there will be one; there's already a lively Internet discussion of MOO II.

There is already a bug patch that you'll need. By the time this is out, there will be more. With modern complex games, it's a safe bet that you ought to check the publisher's Web site for patches before you even begin to play them.

The book of the month is *Higher Education* by Charles Sheffield and Jerry Pournelle, now out in paperback from Tor Books (ISBN 0-812-53890-0). This book was inspired by nonfiction essays about the future, which Dr. Sheffield and I wrote for a meeting of the International Conference on the Unity of the Sciences in 1992. It's a novel about the failure of the U.S. education system and one approach to doing something about it.

The computer book of the month is *Peter Norton's Guide to Windows 95/NT 4 Programming with MFC* by Rob McGregor (Sams Publishing, ISBN 0-672-30900-9). MFC, Microsoft Foundation Classes, is an object-oriented programming language that grew out of the Microsoft AFX. It's much like C++, of course, and it's becoming important for those who want to understand things such as ActiveX. Like all Norton books, this has numerous examples, which are given both in print and on a CD-ROM. The book begins assuming that you know little about MFC but is complete enough to serve as a reference handbook.

Next month: the Chaos Manor User's Choice Awards and the annual Chaos Manor Orchid and Onion parade. Don't miss it. **B**

Jerry Pournelle is a science fiction writer and BYTE's senior contributing editor. You can write to Jerry c/o BYTE, One Phoenix Mill Lane, Peterborough, NH 03458. Please include a self-addressed, stamped envelope and put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on the Internet or BIX at **jerryp@bix.com.**

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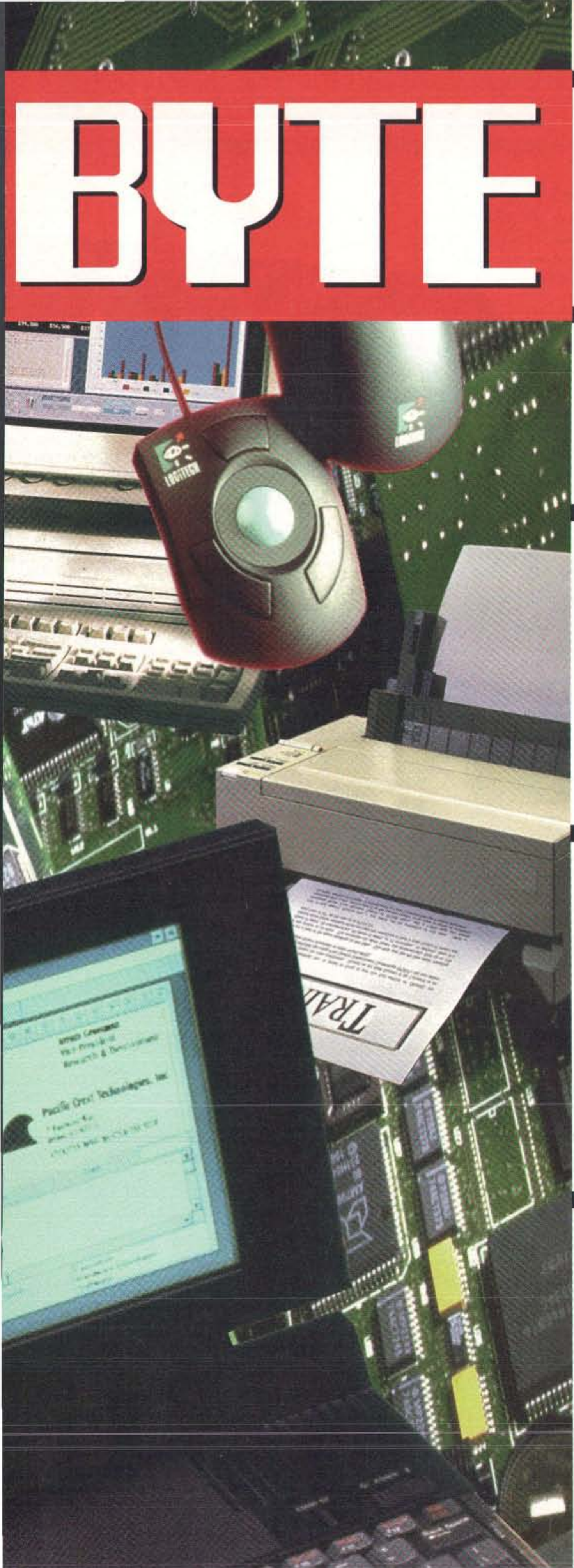

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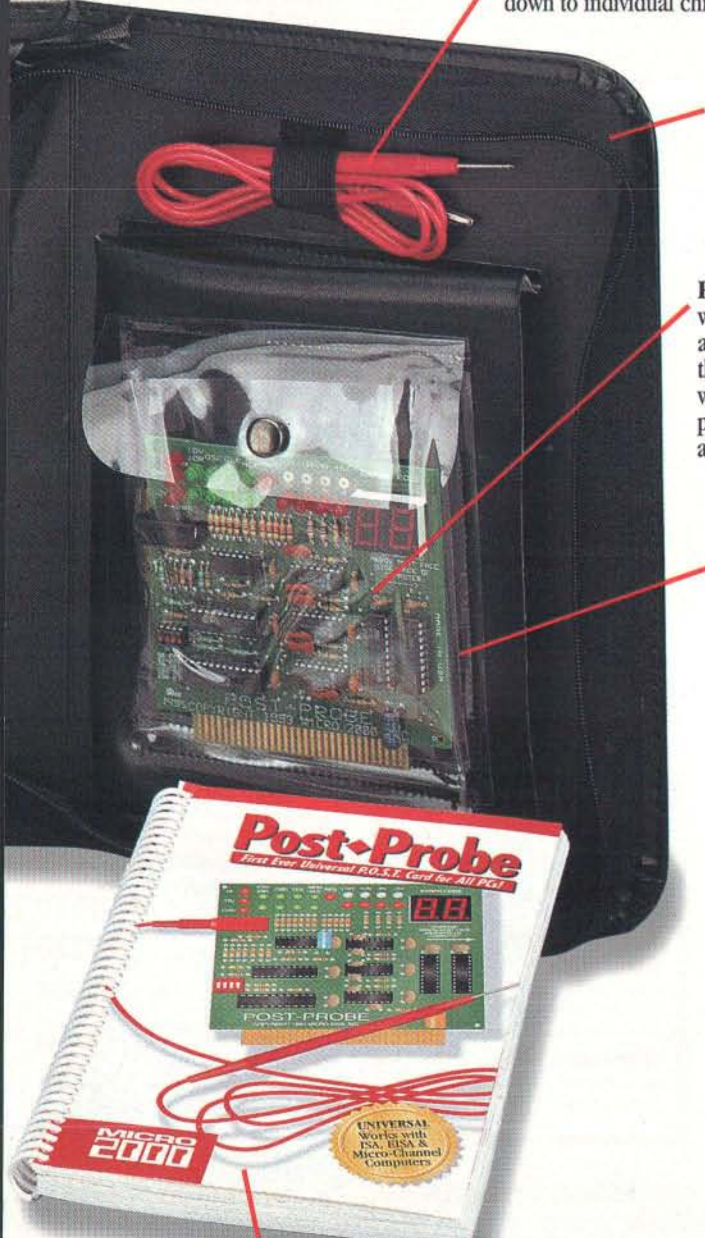
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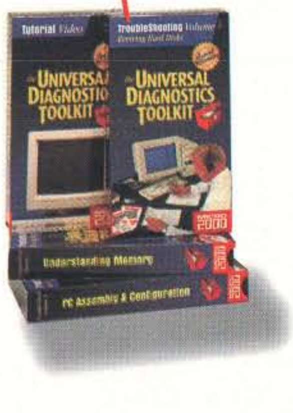

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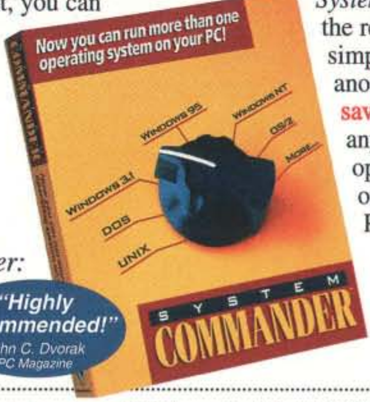

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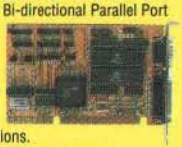

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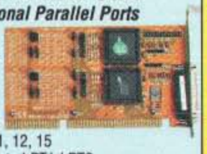

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132214	2-port printer card	$39.95

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- One-year warranty

132572	4-port hi-speed serial card	$49.95

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53719	94000S-80	4MB x 9 80ns	45.95
75117	P361000-xx-7	1MB x 36 (4MB)	34.95
75096	P362000-xx-6	2MB x 36 (8MB)	69.95
75168	P364000-xx-7	4MB x 36 (16MB)	124.95
41515	41256A9B-70	256KB x 9 70ns	9.95
41769	421000A9B-80	1MB x 9 80ns	19.95
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135482	Win '95 104-key keyboard, black	$19.95

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Wide "V" angle conforms to natural position of hands!

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136661	Win '95 ergonomic keyboard	$29.95

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104441	Serial mouse	$10.95

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- Slide switch for video signal gain control
- Includes power adapter 9VDC @ 130mA
- Size: 8.8"L x 6.0"W x 1.9"H • Weight: 3.9 lbs.

133866	4-channel monitor splitter	$79.95

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Included adapter	12VDC @ 400mA	15VDC @ 350mA
Power consmpt.	2.5W (max)	3.6W (max)
Size (L x W x H)	4.0" x 2.2" x 2.0"	7.5" x 5.2" x 1.2"

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- Includes audio and video cable and manual
- Includes durable carrying case
- Weight: 6.7 lbs. • One-year warranty

135976	900MHz observation sys.	$329.95

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- 5.25" half-height design
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- Include audio cable
- **P/Ns 131262 &134391:** include interface card and data cable

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134391	8X ATAPI/EIDE upgrade kit	3.6 lbs.	159.95

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- 600KB/sec. data transfer rate, 150KB audio
- 128KB internal cache buffer
- Weight: 2.5 lbs.

133508	4X 4-disc CD-ROM drive	$99.95

Roadrunner External 4X and 8X CD-ROMs

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131297

- IBM PC/XT/AT/ PS/2 and compatibles
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- Includes power adapter and parallel cable

131297	Ext. 4X CD-ROM, 600KB/sec.	$249.95
135010	Ext. 8X CD-ROM, 1200KB/sec.	329.95

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- CD data and audio cables
- Includes drivers and headphones with mic
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- One-year warranty

135511	8X CD-ROM multimedia kit	$219.95
135520	10X CD-ROM multimedia kit	239.95

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- CD data and audio cables • One-year warranty
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132337	486DX multimedia system	$599.95

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136864	Internal 33.6 modem	$129.95
136872	External 33.6 modem	149.95

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129672	Internal 33.6 modem	$99.95

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- One-year warranty

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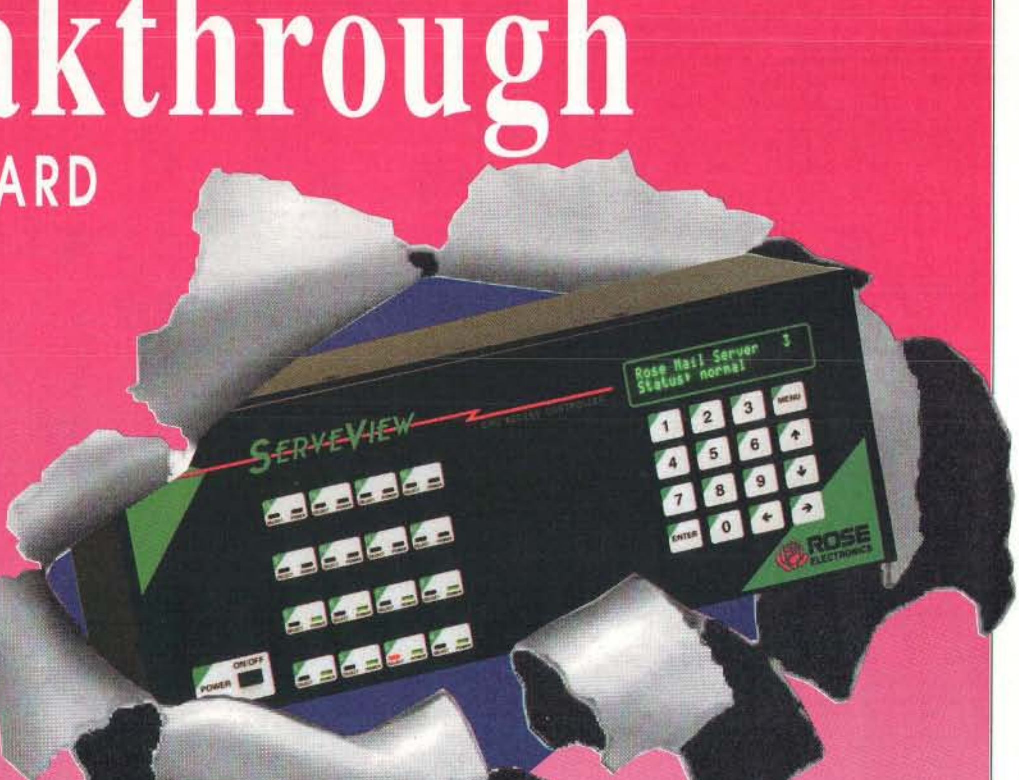

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- NEC Ultralite SL/20/25C/III - 4Meg 29⁰⁰
- T3200 SX - 2Meg Kit 29⁰⁰
- T1900 Series, 4500 Series, 4700 - 4Meg....................39⁰⁰
- Twinhead Subnote 486SX/DX - 4Meg 49⁰⁰
- Compaq Deskpro 386-16 - 4 Meg Exp Bd #118071-001....................59⁰⁰
- Epson 650, 660 & Ambra N-75, N-100 - 4Meg...29⁰⁰
- Panasonic CF-VZIP, CF-580 - 4Meg 29⁰⁰
- SIMMS 1 x 3-70 ....6⁰⁰

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16 x 32 64 mg	Call	Call
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Advantage Adventure 6000	4Meg/8Meg/16Meg/32Meg/64Meg	39/78/124/248/469
Advantage Adventure 8000	4Meg/8Meg/16Meg/32Meg	34/69/124/229
Advantage Pro 486 SX33, SX25	4Meg/8Meg/16Meg/32Meg	34/69/124/229
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PC 350 Model 6586 (pairs)	4Meg/8Meg/16Meg/32Meg	24/49/99/169
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P/S 1, 72 Pin Simms	4Meg/8Meg/16Meg/32Meg	39/59/109/199
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P/S 2, 53, 53LS, 56, 57	4Meg/8Meg	39/69
P/S 2, 95XP (ECC, pairs)	4Meg/8Meg	49/79
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Deskpro 575, 5120, 5133, 5150, 5160 (EDO, pairs)	4Meg/8Meg/16Meg/32Meg	24/42/79/159
Deskpro 2000, 4000, 6000 Series (EDO, pairs)	4Meg/8Meg/16Meg/32Meg	24/42/79/159
Deskpro 5/60M, 5/66M, XE560 (quads)	2Meg/4Meg/8Meg/16Meg/32Meg	39/49/69/139/239
Deskpro XL (pairs)	4Meg/8Meg/16Meg/32Meg	49/69/139/239
Deskpro XL 6150, 6200 (ECC, pairs)	8Meg/16Meg/32Meg/64Meg, 128Meg	Call
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Presario 510, 520, 524, 660, 720, 724, 860	4Meg/8Meg/16Meg/32Meg	24/42/79/159
Presario 920, 924, 954, 974, 978, 992	4Meg/8Meg/16Meg/32Meg	24/42/79/159
Presario 833, 850, 860, 866	4Meg/8Meg/16Meg/32Meg	39/64/119/239
Presario 5528, 7110, 7152	4Meg/8Meg/16Meg/32Meg	24/42/79/159
Presario 7170, 7180, 9536, 9546, 9548, 9564 (pairs)	4Meg/8Meg/16Meg/32Meg	24/42/79/159
Presario 9232, 9234, 9240, 9250, 9642, 9660 (pairs)	4Meg/8Meg/16Meg/32Meg	24/42/79/159
Proliant 1000 5/60, 2000, R, 4000, R (quads)	4Meg/8Meg/16Meg/32Meg	36/62/99/189
Proliant 1500, 1500R (pairs)	4Meg/8Meg/16Meg/32Meg	36/62/99/189
Proliant 4500, 4500R (quads)	4Meg/8Meg/16Meg/32Meg/64Meg	39/64/119/239/599
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Prolinea 5100, 5120, 5133, 5150, 5166 (EDO pairs)	4Meg/8Meg/16Meg/32Meg	36/62/99/189
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Contura 400C, 400CX, 410C, 410CX	4Meg/8Meg/16Meg	49/69/139
Contura 420C, 420CX, 430C, 430CX	4Meg/8Meg/16Meg/24Meg	49/69/139/199
Contura Aero 4/25, 4/33	4Meg/8Meg/16Meg	49/79/1399
LTE 5000, 5100, 5200, 5300	8Meg/16Meg/32Meg/64 Meg Kit	79/129/249/479
LTE Elite 440C, CX, 4/75CX	4Meg/8Meg/16Meg/24Meg	49/69/139/199
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Canon LBP 430	–	–	39	–	–	–	39	–	–	–	–	–
Canon LBP 860, 1260	–	–	–	19	–	–	39	–	–	69	89	179
Canon LBP4, 4Lite, 4plus	–	–	129	179	–	–	–	–	–	–	–	–
Epson 6000, Action Laser	–	–	–	79	–	–	149	–	–	–	–	–
Epson Action Laser 1100, 1600	–	–	19	29	–	–	59	–	–	89	99	–
Epson Action Laser II	–	–	74	–	173	–	–	272	–	–	–	–
Epson 8000, 1800, 4000, 4100, 4300	–	–	89	–	173	–	–	272	–	–	–	–
Epson 1000, 1500, 5000, 5200	–	–	–	69	–	–	138	–	–	–	–	–
HP 2, 2D–	–	–	–	59	–	–	79	–	–	–	–	–
HP 3, 3D, 3P, 2P 2P+	–	–	–	***59***	–	–	***79***	–	–	–	–	–
HP 4, 4M, 4SI, 4SIMX	–	–	–	19	–	–	49	–	–	79	–	–
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HP 3SI	–	–	9	–	–	–	39	–	–	69	–	–
HP 5L	–	–	39	49	–	–	59	–	–	99	–	–
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HP Design Jet 600, 650, 200	–	–	–	19	–	–	39	–	–	69	109	199
HP Deskjet 500, 500C, 510, 550,560	–	***29***	–	–	–	–	–	–	–	–	–	–
HP Deskjet 1200C, 1200C/P	–	–	–	39	–	–	49	–	–	89	–	–
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IBM Laser 4029, 4037	–	–	–	–	–	–	49	–	–	–	–	–
IBM Laser 4039, 4079	–	–	–	***39***	–	–	***69***	–	–	***89***	–	–
Konica LP-3110, 3115	–	–	89	119	159	–	–	–	–	–	–	–
Lexmark Medley 4C, 4x, 4SX	–	–	Call	Call	Call	–	–	–	–	–	–	–
Lexmark, Optra L, LX, R, RX	–	–	–	–	–	–	39	–	–	59	89	169
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Lexmark Winwriter 200, 400, 600	–	–	29	39	–	–	89	–	–	–	–	–
NEC 90, 290	–	–	–	89	–	–	–	–	–	–	–	–
NEC 95, 97	–	–	–	79	–	–	–	–	–	–	–	–
Oki 400	–	–	–	69	–	–	–	–	–	–	–	–
Oki 400E, 400EX, 410E, 410EX	–	–	89	109	169	–	189	–	–	–	–	–
Oki 810E, EX, 600E, EX, 610E, EX	–	–	29	39	–	–	69	–	–	99	129	–
Oki 830, 840	–	–	–	89	–	–	–	–	–	–	–	–
Oki 2350, 2450	–	–	Call	Call	–	–	–	–	–	–	–	–
Panasonic 4420/4450i	–	–	–	79	–	–	149	–	–	–	–	–
Panasonic 4410/4430	–	–	–	***69***	–	–	***109***	–	–	–	–	–
Panasonic 4450	–	–	89	–	–	–	–	–	–	–	–	–
Panasonic 4400/5400	–	–	49	69	–	–	119	–	–	–	–	–
Panasonic 4440, 5410	–	–	69	–	–	–	109	–	–	–	–	–
Panasonic 6500	–	–	14	29	–	–	79	–	–	–	–	–
Sharp 9400, 9460, 9600, 9700E	–	–	49	69	–	–	119	–	–	–	–	–
Sharp 9500, E, H, 9700, H	–	–	49	–	–	–	99	–	–	–	–	–
TI Microlaser Pro E, Powerpro, Pro 600	–	–	39	49	–	–	59	–	–	99	–	–
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Compaq LTe 5000 Series	109	TI Exstensa 450, 455, 510, 515	139
Epson Action Note 650, 660	162	TI Exstensa 550, 555, 560, 570	149
Epson Action Note 800, 866, 880, 910	154	TI Exstensa 600, 605, 650	181
IBM Thinkpad 355, 360	92	Toshiba 600, 610	Call
IBM Thinkpad 365 C, ED, XD	92	Toshiba 400, 405, 410, 415, 420, 425, 430	193
IBM Thinkpad 701	92	Toshiba 100, 105, 110, 115, 200, 205	89
IBM Thinkpad 750, 755	159	Toshiba 2100 Series	89
IBM Thinkpad 755 CD, CE, CV, CX	159	Toshiba 2400, 2450, 1900, 1950, 1960	109
NEC Versa 2000, 2200, 2205	Call	Toshiba 4700, 4800, 4850, 4900	109
NEC Versa E, V	118	Toshiba T4500, T4600	139

TOSHIBA LAPTOP MEMORY

MODEL	AMT. UPGRADED	PRICE
Tecra 500/P650	***8Meg/16Meg/32Meg/48Meg/128Meg***	***79/129/249/349***
Tecra 700 (SDRAM)	***8Meg/16Meg/32Meg***	***79/139/299***
Tecra 710, 720	***8Meg/16Meg/32Meg/64Meg/128Meg***	***69/129/209/1020/2040***
T2000SXE/2200SX/T1800, 1850, C	8Meg	94.00
T2100, 2105, 2150, 2155, 2110, 2115	4Meg/8Meg/16Meg/24 Meg	49/69/139/199
T4500, C, T4600, T4700, T1900, C, T1910, T1950 (3.3 v)	4Meg	39.00
T4500, C, T4600, T4700, T1900, C, T1910, T1950 (3.3 v)	8Meg	79.00
T4500, C, T4600, T4700, T1900, C, T1910, T1950 (3.3 v)	16Meg/32Meg	139/279
T3400CT, T2400, T3600	4Meg/8Meg/16Meg/24Meg	59/79/149/199
T100, 105, 110, 115, 205, 210	***8Meg/16Meg/32Meg***	***69/129/209***
T400, 405, 410, 415, 420, 425, 430	***8Meg/16Meg/32Meg***	***69/129/209***
T400CS, 400CDT, T100, 105 Edo	***8Meg/16Meg/32Meg***	***69/129/209***
T600, 610, CT Edo, 660	8Meg/16Meg/32Meg	69/129/209

NOTEBOOK, LAPTOP MEMORY

MODEL	AMT. UPGRADED	PRICE
ACERNote 730C, 735C, 760C, 760CX, 780CX	2Meg/4Meg/8Meg	39/59/89
ACERNote 763, 765, 782, 784, 786	4Meg/8Meg/16Meg	59/79/139
ACERNote Light 350, 352, 355	4Meg/8Meg/16Meg	59/79/139
ACERNote Light 356, 358, 359, 361 (pairs)	4Meg/8Meg/16Meg	59/79/139
ACERNote Nuovo 971, 972	***8Meg/16Meg/32Meg***	***69/125/239***
ACERNote Pro 950, 954, 955, 957, 959 (pairs)	4Meg/8Meg/16Meg	59/79/139
Ambra N Series	***4Meg/8Meg/12Meg/16 Meg***	***89/109/139/189***
Ambra SN Series	4Meg/16 Meg	79/179
Ambra N-75, N-100	4Meg/8/16	49/79/139
AST Ascentia A Series	***8Meg/16Meg/32Meg/64Meg***	***75/139/269***
AST Ascentia P30, P50	***8Meg/16Meg/32Meg***	***89/189/309***
AST Ascentia J10, J30,J50	***8Meg/16Meg/32Meg/40Meg Kit***	***79/159/309/359***
AST Ascentia 900N, 800N, 810, 910	8Meg/16Meg	79/119
AST Ascentia 950	8Meg/16Meg	79/119
AST Bravo & Explorer	***4Meg/16Meg***	***79/219***
AST Notebook Prem Exec 386SX/20/25/25L	4Meg	69.00
AST Power Exec 3/25C, 425EL, 425SL	4Meg/16Meg	69/139
AST Power Exec 4/33SL	4Meg/16Meg	69/139
AT&T Globalyst 130, 200, 250	4Meg/8Meg/16Meg	69/99/149
Austin DX4, DX2, SX2, SX Series	4Meg/16Meg	69/189
Austin Edge	***8Meg/16Meg***	***89/149***
Austin Edge Duel	***16Meg/32Meg***	***199/399***
Austin Vista	***4Meg/8Meg/16Meg/24Meg***	***69/99/219/349***
Canon 1100	4Meg/8Meg/16Meg	Call
Canon Innova Book 150, 175	4Meg/16Meg	59/139
Canon Innova Book 200LS	4Meg/8Meg/16Meg/24Meg	69/99/219/349
Canon Innova Book 350CD, 360, 475	***8Meg/16Meg***	***69/139***
Canon Innova Book 480, 490	***8Meg/16Meg***	***89/149***
CTX EZ Book 5x86 Pent. Series	***4Meg/8Meg/16Meg***	***59/89/139***
DEC HiNote, Ultra HiNote	4Meg/8Meg/16Meg	59/89/139
DEC HiNote Ultra, Ultra II	***4Meg/8Meg/16Meg***	***59/89/139***
DEC HiNote VP 520, 525, 535	***8Meg/16Meg/32Meg***	***89/139/289***
DEC HiNote VP 5100, 5120	***8Meg/16Meg/32Meg/64Meg***	***89/179/399/599***
DEC HiNote VP	***8Meg/16Meg/32Meg***	***79/139/269***
Dell Latitude LM (pairs)	***4Meg/8Meg/16Meg***	***69/99/189***
Dell Latitude 433, C, CX	4Meg/16Meg	69/149
Dell Latitude LMP (pairs)	4Meg/8Meg/16Meg	59/89/139
Dell Latitude LX, M	4Meg/8Meg/16Meg	59/89/139
Dell Latitude XP, XPI	4 Meg/8Meg/16Meg	59/89/139
Epson ActionNote 650, 650c, 660c, 660cx	4Meg/8Meg/16Meg	39/79/139
Epson ActionNote 700, 700c, 700cx	4Meg/16Meg	69/149
Epson ActionNote 880, 866c, 890	4Meg/8Meg/16Meg/20Meg	59/89/159/199
Epson ActionNote 4LC/25, 4LC/33, 4SLC/2-50, 4000	8Meg	69.00
Fujitsu Monte Carlo, Montego, Milan	***8Meg/16Meg/32Meg***	***69/139/269***
Gateway 2000 Colorbook 4/33	4Meg/16Meg	69/179
Gateway 2000 Nomad 425 DXL/SXL	4Meg/16Meg	140/559
Gateway 2000 486 Handbook or Liberty	4Meg/16Meg	49/139
Gateway 2000 Solo Series	4Meg/8Meg/16Meg	69/89/139
Gateway 2100 Solo Series	8Meg/16Meg	119/209
Hitachi C-Series	***8Meg/16Meg/32Meg***	***79/149/219***
Hitachi E-Series	***8Meg/16Meg/32Meg***	***79/139/269***
Hitachi M-Series	***8Meg/16Meg/32Meg***	***79/129/269***
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HP Omnibook 530, 600	4Meg/8Meg/12Meg	49/69/99
HP Omnibook 800	8Meg/16Meg/32Meg	79/119/209
HP Omnibook 4000	4Meg/8Meg/16Meg	69/89/169
HP Omnibook 5000, 5500	8Meg/16Meg/32Meg	69/119/219
Leading Edge Aviva 2000	4Meg/16Meg	59/139
Lexmark SE10	4Meg/8Meg	69/99
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Sharp 3010, 3020, 3050, 3060	4Meg/8Meg/16Meg/32Meg	49/69/139/399
Sharp 9000, 9030	8Meg/16Meg/32Meg	79/189/399
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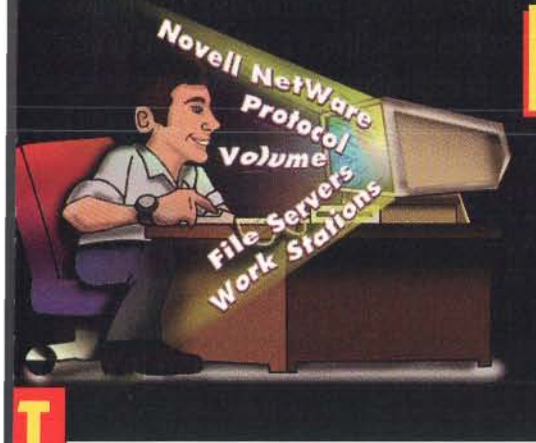

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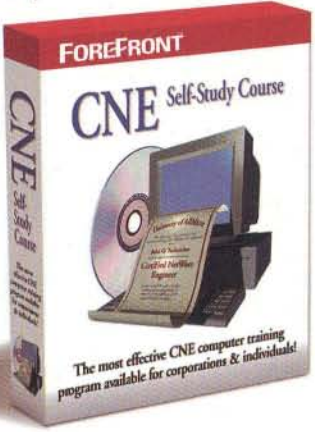
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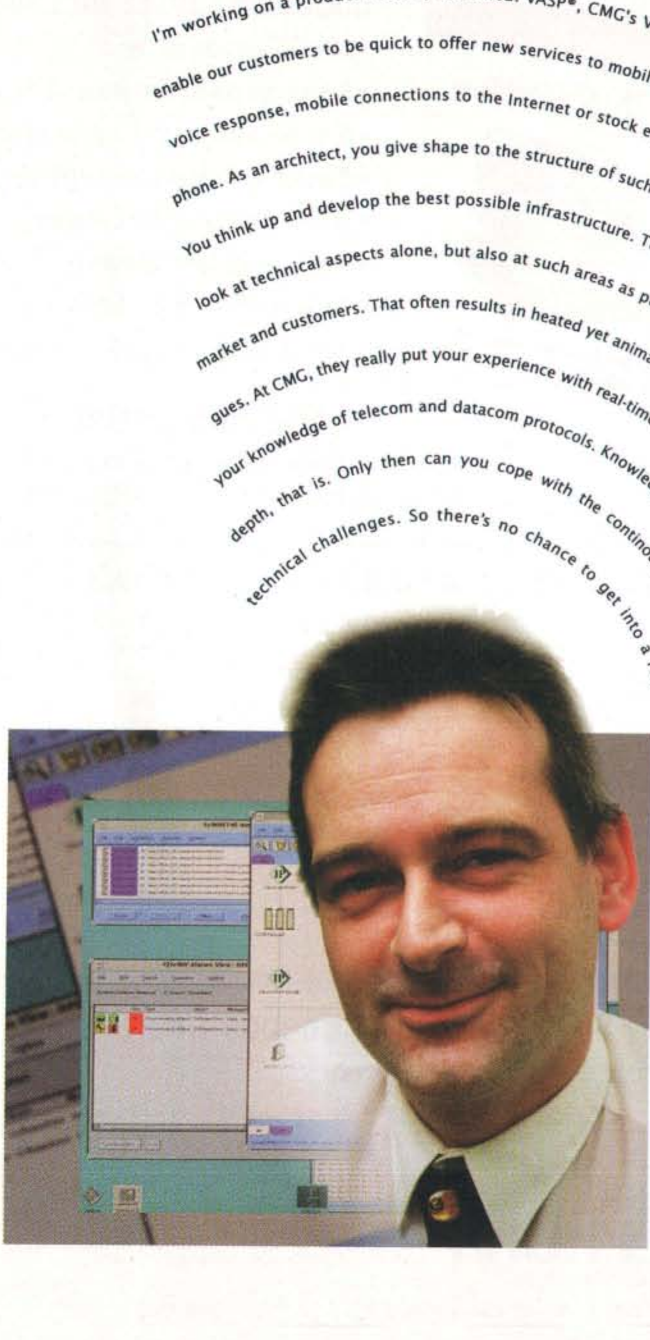

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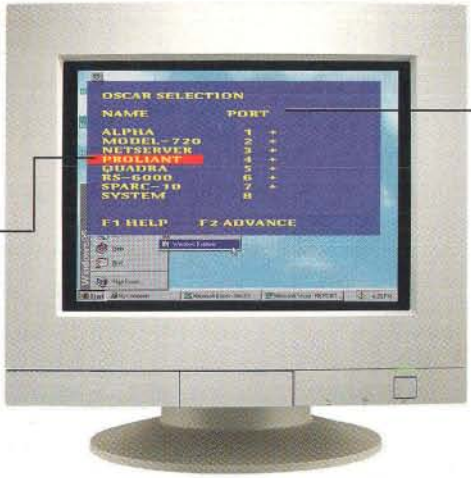

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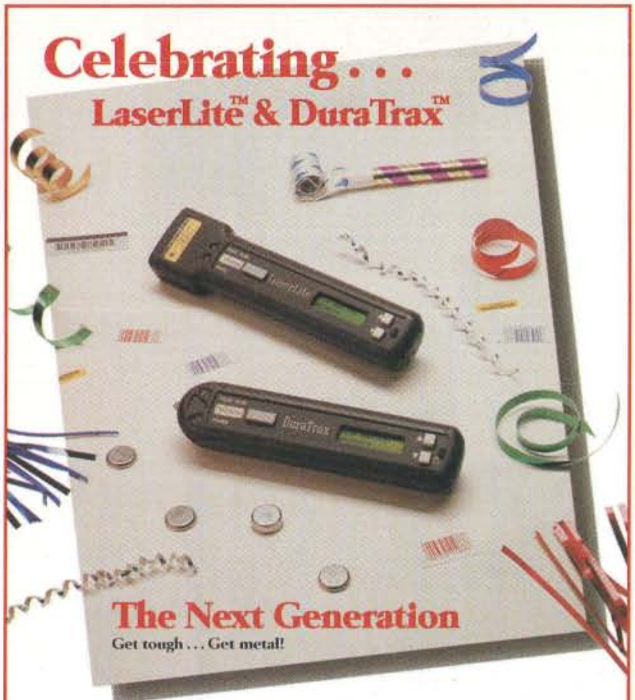

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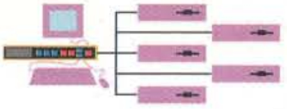

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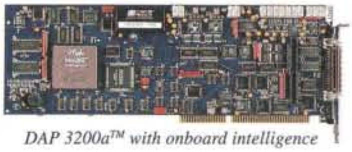

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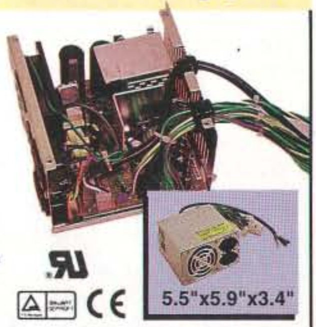

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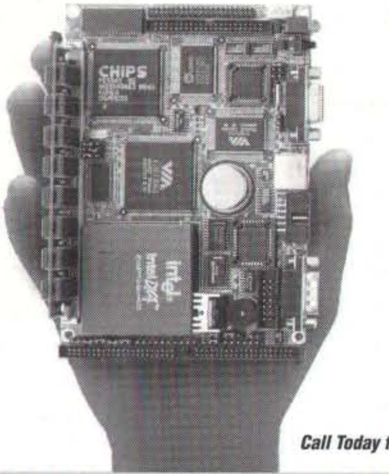

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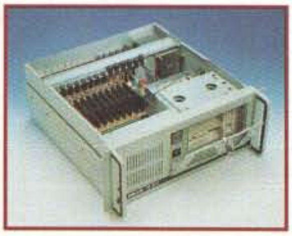

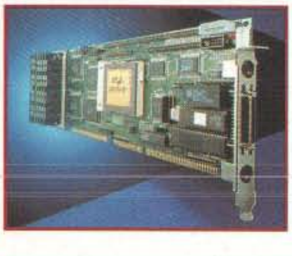

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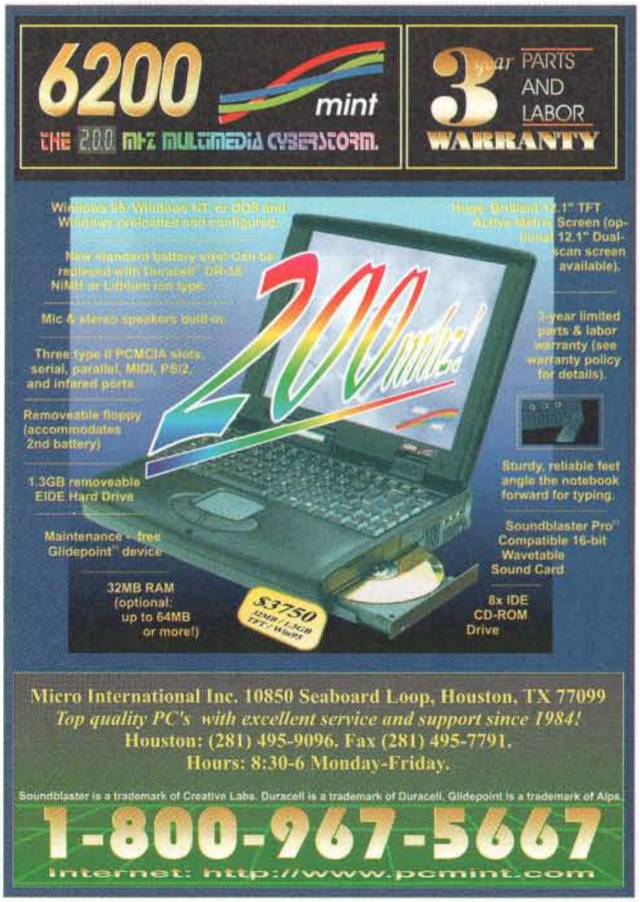

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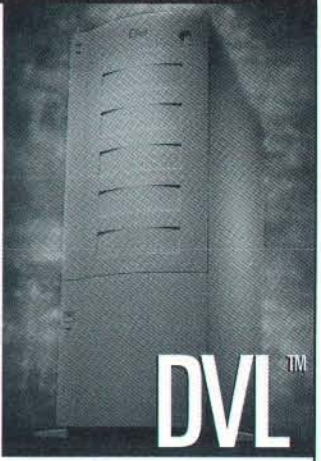

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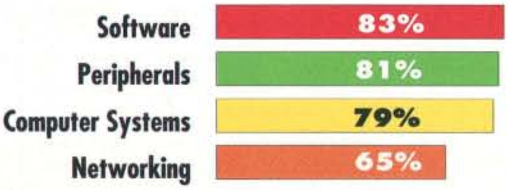

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753	LIGATURE LTD	40IS 42	+972-2-651-3553
712	LOGIC PROGRAMMING ASSOCIATES	40IS 20	800-949-7567
	M		
744-745	MEGASOFT GMBH	40IS 24	+43-1-470202277
124	MEMORY ON-LINE	167	714-488-0477
207	MICRO 2000	150-151	818-547-0397**
*	MICRO-INTERNATIONAL INC	166	800-967-5667
162	MICRON ELECTRONICS	70-71	800-723-2998
163	MICRON ELECTRONICS	86-87	800-486-2059
161	MICRON ELECTRONICS	CII-I	800-362-7306
*	MICROSOFT CORPORATION	2-3	
*	MICROSTAR LABORATORIES	164	206-453-2345
*	MICROWAY	99	508-746-7341
146	MINITAB INC	75	814-238-3280
713	MINOLTA GMBH	40IS 19	+49-511-7404-401
715-716	MINUTEMAN	CV	+972-446-7363
181-182	MIRO COMPUTER PRODUCTS AG	53	+49-531-2113-100
729-730	MITAC	40IS 26	+88633280927
118	MOXA TECHNOLOGIES	162	800-699-MOXA
218-219	MULTIVENTURE MARKETING CORP	40IST 16	+886-2-703-1380
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90	NATIONAL INSTRUMENTS	164	800-433-3488
714	NATIONAL INSTRUMENTS	40IS 35	800-433-3488
115	NEATO LLC	167	800-984-9800
*	NETWORLD+INTEROP	117	800-488-2883
238	NSTL	119	610-941-9600
188-189	NSTOR CORPORATION	23	800-724-3511
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*	ON TIME	40IS 20	+49-40-227-9405
*	OSBORNE MCGRAW-HILL	46-47	800-822-8158
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*	PCI PLUS	146	800-690-3858
717	PERSOFT INC	40IS 39	608-273-6000
186-187	PHILIPS BUSINESS ELECTRONICS	88	800-835-3506
148-149	PINNACLE MICRO	7	714-789-3000
741-742	PK ELECTRONICS	40IS 22	+6066772993
150	PKWARE INC	107	414-354-8699
197-198	PLASMON DATA INC	83	+44 (0) 1763 261334*
169	POWERSOFT	29	800-395-3525
743	PRIME ELECTRONICE TRADING GMBH	40IS 10	+49-40-484080
183-184	PRINCETON GRAPHIC SYSTEMS	35	714-751-8405
723-724	PSI PRINTER SYSTEMS INTL	181	+49-271-3597-190**
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151	QNX SOFTWARE SYSTEMS LTD	18	800-656-0566 ext 1041
91	QUALSTAR CORP	166	800-468-0680
94-95	QUATECH INC	162	800-553-1170
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762	RADCOM LTD	40IS 42	+972-3-645-5055
177-178	RAIDTEC CORPORATION	15	770-664-6066
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754-755	RECOGNITA	40IS 41	+36-1-2018925
100-101	RECORTEC INC	165	888-RECORTEC
205-206	ROSE ELECTRONICS	157	800-333-9343
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171	SAG ELECTRONICS	58	508-682-0055
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760-761	SEH COMPUTERTECHNIK GMBH	40IS 40	+49-521-94226-0
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- 2 ☐ Manufacturer (other than computer)
- 3 ☐ Finance/Insurance/Real Estate
- 4 ☐ Education/Medical/Law
- 5 ☐ Business Service
- 6 ☐ Manufacturer of Computers, Data Systems Hardware or Peripherals (OEM)
- 7 ☐ Government: Federal/State/Local
- 8 ☐ Public Utilities, Communications Systems or Transportation Systems
- 9 ☐ Wholesale/Retail/Trade
- 10 ☐ Other (Please specify): ____________

B. Title/Function: (Check one)
- 11 ☐ Senior Company Management
- 12 ☐ Senior IS/IT Management
- 13 ☐ IS/IT Management
- 14 ☐ Application Development/Integration
- 15 ☐ Technical Support Services
- 16 ☐ Operations/Manufacturing
- 17 ☐ Systems/Networking
- 18 ☐ Systems Engineering/Integration
- 19 ☐ Department Management (non-IS/MIS)
- 20 ☐ Consulting
- 21 ☐ Other (Please specify): ____________

C. Do you evaluate, specify, recommend, purchase: (Check all that apply)
- 22 ☐ Application Development Products
- 23 ☐ Networking/Communication Products
- 24 ☐ Operating Systems
- 25 ☐ Large Systems (Mainframes/Minis)
- 26 ☐ Desktops (Micro's/Workstations)
- 27 ☐ Systems Software Products
- 28 ☐ Application Software Products
- 29 ☐ Peripheral Equipment
- 30 ☐ Telecommunications Services

D. How many people are employed at this location and your entire organization:

At this location		Entire Organization
31 ☐	10,000+	37 ☐
32 ☐	5,000-9,999	38 ☐
33 ☐	1,000-4,999	39 ☐
34 ☐	500-999	40 ☐
35 ☐	100-499	41 ☐
36 ☐	Under 100	42 ☐

E. What is the scope of your purchase involvement?
- 43 ☐ Company wide
- 44 ☐ Division wide
- 45 ☐ Department wide
- 46 ☐ Individual

March 1997

90 97 98

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To receive information for an entire category, circle the appropriate number in box above.

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Accessories/Supplies	1
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Bar Coding	3
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Data Acquisition	6
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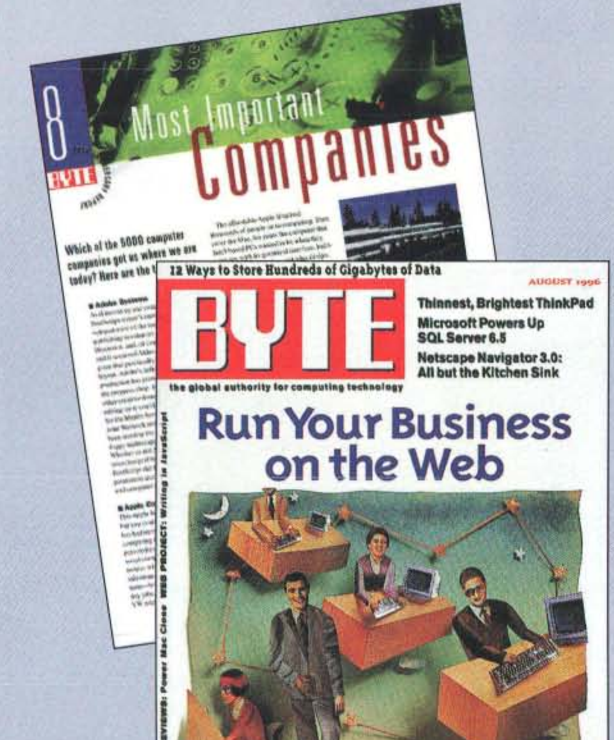

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9 Technologies

California garages again store cars and junk, not computer research labs as they did in the halcyon days of Woz and Jobs. Today, the myths may be tamer, but the pace of innovation hasn't changed. Here are the major technologies of the past 20 years.

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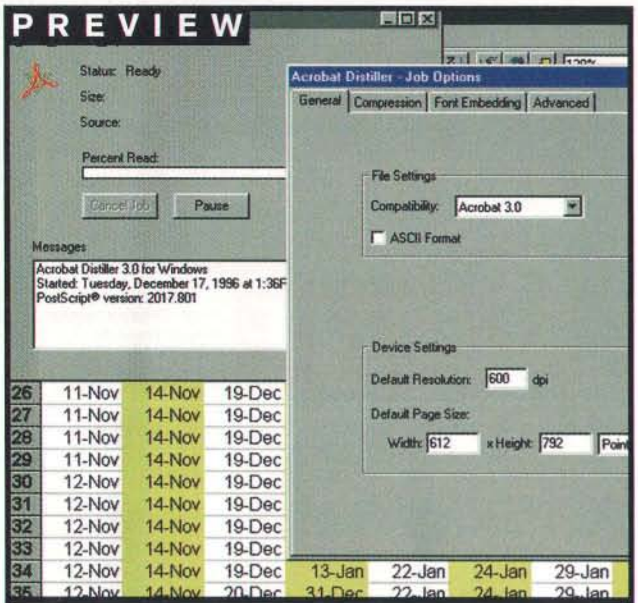

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Acrobat Does Web Integration

Adobe's Portable Document Format (PDF) hasn't made the paperless office a reality, as many people thought it might when the product first shipped two years ago. However, it has changed work habits at many businesses, particularly graphics-intensive ones such as publishing, advertising, and engineering. With Adobe Acrobat, you can distill ponderous, graphics-heavy documents into tidy, e-mailable files that long-distance clients and coworkers can view and annotate electronically.

Adobe has added a hefty list of Web-integration features to Acrobat 3.0. You can view Acrobat files within Web browsers such as Netscape Navigator and Microsoft Internet Explorer. You can also embed a PDF file into a Web page so that it can be viewed on the fly, provided the user has the Acrobat 3.0 Reader. The new Acrobat also provides better compression and more choices for compressing graphics. Acrobat 3.0 compressed an 83-KB PostScript file created by QuarkXPress to 33 KB, compared to 50 KB when compressed by Acrobat 2.0. Version 3.0 supports JPEG, LZW, and ZIP compression options.

With additional power, however, comes added size. The Adobe Reader has increased from 1.5 MB to more than 2 MB.

Overall, Adobe Acrobat 3.0 adds welcome power and features, particularly in the area of Web publishing. **–Jenny Donelan**

Animation

3-D Modeling and Animation

THE WINDOWS 95/NT VERSION OF INFINI-D 3.5 ($649) supports Apple's QuickDraw 3D technology on the Windows platform. You can import and export 3DMF objects, use the QuickDraw 3D renderer, and manipulate objects, cameras, and lights in real time. Animated SuperFlares let you create lens flare and lighting effects in the 3-D environment.

Contact: Specular International, Amherst, MA, (800) 433-7732 or (413) 253-3100; http://www.specular.com.
Circle 981 on Inquiry Card.

Graphics

32-bit Design and Illustration Program

A VECTOR- AND RASTER-BASED GRAPHICS program for creating photo-realistic images, RIO Designer Professional ($299) for Intel, Alpha, Mips, and PowerPC platforms includes resolution-independent output; unlimited grouping and layering; and polygon, text, freehand, and Bézier-curve shape creation. You also get anti-aliased text, graphics, and images; and image processing, including embossing, posterizing, pixelizing, softening, negative, and high-contrast.

Contact: Lucent Technologies, Inc., Maitland, FL, (800) 892-8550 ext. 333 or (407) 662-7254; http://www.bell-labs.com/org/ssg.
Circle 982 on Inquiry Card.

Macintosh

Add Features to Your Web Browser

NOW AVAILABLE FOR THE MACINTOSH, WEB Buddy (about $50) assists Web browsers in collecting, converting, organizing, and sharing information you find on the Web. The program automatically collects Web pages and entire Web sites while you are doing other things and serves as a bookmarking utility.
Contact: DataViz, Inc., Trumbull, CT, (800) 733-0030 or (203) 268-0030; http://www.dataviz.com/webbuddy.
Circle 983 on Inquiry Card.

OS/2

Better Recovery for OS/2 Hang-Ups

WHEN YOUR OS/2 WARP 3.0 OR 4.0 SYSTEM hangs, you can press Ctrl+Alt+Del, which Process Commander ($69.95) traps and then allows you to try to recover (e.g., when the message queue hangs). The program also provides an enhanced shutdown, which allows you to tell OS/2 to reboot after shutting down.

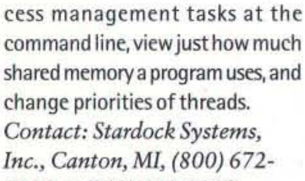
This month, we preview Adobe's Acrobat 3.0, which adds Web-integration and better compressing features, and HP's ScanJet 5p, with improved design and image quality.

You can write scripts, perform process management tasks at the command line, view just how much shared memory a program uses, and change priorities of threads.
Contact: Stardock Systems, Inc., Canton, MI, (800) 672-2338 or (313) 453-0328; http://www.stardock.com.
Circle 984 on Inquiry Card.

Programming

Create Geographic Systems

The WinMap Software Developers Kit (from $5000) allows you to create geographic viewing and querying systems on a PC without having to learn geographic outline coding.



The package includes the WinMap Development Station, a DDE/OLE database engine for spatial relationships; WinGIS Plus, for creating base maps from graphics data sources; a DDE/OLE Toolkit, which links the WinGIS engine to databases that support DDE or OLE; and the Progis Import Tool, for importing map attribute data.
Contact: Progis Corp., Bellingham, WA, (360) 738-2449; http://www.progis.com.
Circle 985 on Inquiry Card.

Build Applications for the Internet/Intranets

With Passport IntRprise (single developer's license, $8995), you can build applications that use Java front ends for Internet/intranet deployment and also support transaction processing, a multitier architecture, and fault tolerance for enterprise computing. Your applications can run on the Internet/intranet or internally as a client/server multitier application. The product supports Windows 3.1, 95, and NT; and Unix.
Contact: Passport Corp., Paramus, NJ, (800) 926-6736 or (201) 634-1100; http://www.passport4gl.com.
Circle 986 on Inquiry Card.

Cross-Platform Software Testing Tool

TestWeb (per seat, $6600) automates regression testing for PC- or NC-based applications, drivers, OSes (e.g., Windows 3.1, 95, and NT; and Unix Motif), BIOSes, and Web applications. Eastern Systems' program includes Web-content testing, user-interface testing, hyperlink verification, regression testing, compatibility testing, and stress or load testing. You can improve test efficiency using TestWeb's remote capability for test execution, viewing, and analysis via a Web-browser interface and schedule, run, and analyze off-site tests via the Web.
Contact: Eastern Systems, Inc., Westboro, MA, (508) 366-3223; http://www.easternsystems.com.
Circle 987 on Inquiry Card.

Tax Preparation

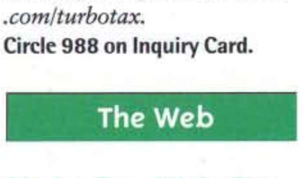
TurboTax and MacInTax for 1996

TurboTax and MacInTax for 1996 ($34.95; Deluxe, $49.95) include Where Am I?, which improves your ability to navigate through your tax return; Smart Final Review, which checks your return for errors and provides helpful hints, planning tips, and money-saving suggestions; Refund Monitor, which shows your tax refund or amount due at a glance when you enter each new piece of data; and Enhanced State Assistant, which guides you through your state tax-preparation process with an EasyStep question-and-answer session.
Contact: Intuit, Inc., Tucson, AZ, (800) 446-8848 or (520) 295-3000; http://www.intuit.com/turbotax.
Circle 988 on Inquiry Card.

The Web

All-In-One Web-Site Creation Suite

The Web Studio ($129) suite of applications includes WebEdit, an HTML editor; Crystal Reports, Seagate Software's database-access and report-generating program for publishing data on the Internet; a GIF image editor; WebMap, an image map editor that allows you to create image maps and define hidden links for clickable areas of a picture; and tools for developing interactive Java applets, including Sun Microsystems' Java Developer's Kit.



Contact: Luckman Interactive, Inc., Los Angeles, CA, (800) 711-2676 or (213) 614-0966; http://www.luckman.com.
Circle 990 on Inquiry Card.

Multilingual Communications for Internet Users

Now you can read, view, and process Eudora, Lotus cc:Mail, and Netscape Navigator e-mail messages in 23 foreign languages. GlobalSurf ($99) lets you explore the Internet with standard Web browsers and e-mail applications in different languages and select combinations of language toolbar buttons. A floating on-line keyboard helps you enter text in a foreign language, and an integrated on-line dictionary lets you quickly translate among Chinese, Japanese, and English.
Contact: DynaLab, Inc., Santa Clara, CA, (888) 839-6252 or (408) 490-4224; http://www.dynalab.com.
Circle 989 on Inquiry Card.

Windows 95

Solve Windows 95 Problems

From printer-hookup complications to changing desktop icons to serious hard drive problems, PC Handyman ($49.95) solves more than 20,000 hardware and software problems and performs 16 regularly scheduled hardware and software checks. The package includes Norton CrashGuard with Anti-Freeze, which protects you from losing important files as a result of application crashes and freezes.
Contact: Symantec Corp.,

Cupertino, CA, (800) 441-7234 or (541) 334-6054; http://www.symantec.com/PressCenter/.
Circle 991 on Inquiry Card.

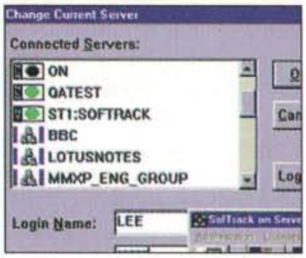
Windows NT

Plan Client/Server Systems

A PERFORMANCE-MODELING TOOL, SES/strategizer ($9500) can integrate the pieces of a client/server environment, such as networks, applications, databases, and user behavior. The product for Windows NT provides performance-prediction and decision-support facilities. It comes with a graphical editor for defining network topology, hardware device characteristics, applications, databases, and work loads; menus and dialog boxes for user-specified model inputs; and standard graph operations.
Contact: SES, Inc., Austin, TX, (800) 759-6333 or (512) 328-5544; http://www.ses.com.
Circle 993 on Inquiry Card.

Metering Across NT and NetWare Servers

NOW YOU CAN METER SOFTWARE LICENSE usage on Windows NT servers. SofTrack for Windows NT (25 users, $795; 50 users, $995) lets you centrally manage software licenses and ensure compliance with licensing terms. You can produce such reports as number of licenses in use, usage by user name, maximum concurrent usage, and total time each license is in use. SofTrack for Windows NT shares licenses between NetWare and NT servers.
Contact: On Technology Corp., Cambridge, MA, (800) 767-6683 or (617) 374-1400; http://www.on.com.
Circle 992 on Inquiry Card.


Change Current Server
Connected Servers:
ON
QATEST
ST1:SOFTRACK
BBC
LOTUSNOTES
MMXP_ENG_GROUP
Login Name: LEE

Software Updates

WanderLink 2.2, the remote-access solution for NetWare LANs, offers a LAN dial-out client, enhanced remote control, and built-in security. Two-port, $495; four-port, $795; eight-port, $1395; 16-port, $2595.
Contact: Funk Software, Inc., Cambridge, MA, (800) 828-4146 or (617) 497-6339; http://www.funk.com.
Circle 994 on Inquiry Card.

The latest version of the technical-calculation software package, **Mathcad Plus 6 for the Macintosh**, includes a "live" document interface that lets you integrate text, calculations, and graphs, and then document and share results; the ability to create and embed animation within a worksheet; and direct graphing of formulas and expressions. $349.95.
Contact: MathSoft, Inc., Cambridge, MA, (800) 628-4223 or (617) 577-1017; http://www.mathsoft.com.
Circle 995 on Inquiry Card.

The **WinHelp Office 4** suite includes RoboHelp 4, ActiveX Controls, Moving-to-HTML Kit, WinHelp HyperViewer, What's This? Help Composer, WinHelp Tool Kit, Mastering WinHelp, and WinHelp Video Kit. $699.
Contact: Blue Sky Software Corp., La Jolla, CA, (800) 459-2356 or (619) 459-6365; http://www.blue-sky.com.
Circle 996 on Inquiry Card.

HARDWARE

Accessories

Internet Telephone Keyboard

YOU CAN MAKE AND RECEIVE PHONE CALLS from your keyboard, even typing as you talk. The CompuNet 2000 PC Internet Telephony Device ($249) features a keyboard, a built-in telephone handset and dialing pad, and Internet telephony circuitry. Features include automatic call logging and dialing direct from virtually any application. It is compatible with most telephone headsets.
Contact: Gemini Industries, Inc., Clifton, NJ, (201) 471-9050; http://www.gemini-usa.com.
Circle 998 on Inquiry Card.

Wireless Keyboard

YOU CAN OPERATE THE WIRELESS SURFBoard ($399) keyboard and perform mouse operations at distances of 50 feet or more. The compact 83-key keyboard comes with a mouse touchpad with dual mouse buttons, a mouseport for connecting an external pointing device, a joystick port, and RF wireless technology. Standard AA batteries give you more than 100 hours of nonstop use.
Contact: Wireless Computing, Irving, TX, (972) 719-2515; http://www.cpgs.com/wireless.
Circle 999 on Inquiry Card.

Connectivity

Router Links Ethernet to Internet

THE MODEL 9010 WEB ROUTER ($995) provides full-time connectivity from an office to the Internet via frame relay or other WAN services. The product lets a single Ethernet segment, a campus LAN, or a host on a serial port provide Internet access. The device supports IP, PPP, SLIP, and BootP protocols with data transfer rates of 56 KBps to T1 speeds. The Web Router allows individual addresses or ranges of addresses to start and end anywhere, even across subnets. The user connection is 10Base-T and AUI; an RS-232 interface is also available. The Web Router is powered by a wall-mounted power supply.
Contact: Telebyte Technology, Inc., Greenlawn, NY, (800) 835-3298 or (516) 423-3232; http://www.telebyteusa.com.
Circle 1000 on Inquiry Card.

Palm-Size UPS Monitor

A HAND-HELD ELECTRONIC DISPLAY PAD, the PowerView UPS Management Module ($249) lets you monitor and configure your Smart-UPS or Matrix-series UPSes without using a PC. Mounted outside a rack, the display can provide critical power information without key access. The product provides multiple language support, downloading and uploading of one UPS's configuration to other UPSes for quick setup and management of multiple UPSes, and nonvolatile memory.
Contact: American Power Conversion, West Kingston, RI, (800) 877-4080 or (401) 789-5735; http://www.apcc.com.
Circle 1006 on Inquiry Card.

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from Data Communications**

www.data.com

Videoconferencing Kit for Pentium PCs

A DESKTOP VIDEOCONFERENCING PACKAGE for PCs with a 100-MHz Pentium processor and Windows 95, the Supra Video Phone Kit 3000 ($399) features a SupraExpress 33.6-Kbps V.80 internal modem, a Diamond Crunch It 1001 video-capture card, a camera with a microphone, VDONet videoconferencing software, and cables. Crunch It 1001 supplies live video for video phone calls and captures video to disk for editing and playback. The cord connects to the kit's camera and microphone and to a composite or S-VHS camcorder or VCR.
Contact: Diamond Multimedia Systems, Inc., San Jose, CA, (800) 727-8772 or (408) 325-7000; http://www.diamondmm.com.
Circle 1001 on Inquiry Card.

Peripherals

Portable 10-Speed CD-ROM Drive

THE PROMEDIA 10XR (ABOUT $429) draws power from a laptop computer via a Type II PC Card. The CD-ROM drive has a data transfer rate of 1.5 MBps and supports 32-bit Plug and Play, so you can hot-swap the drive while the PC is on. You can insert an auto-play disc and instantly run CD-ROM titles without clicking on program icons or performing setup procedures.
Contact: Axonix Corp., Salt Lake City, UT, (800) 866-9797 or (801) 521-9797; http://www.axonix.com.
Circle 1003 on Inquiry Card.

LaserJet 5Si Upgrade Kit

YOU CAN UPGRADE YOUR LASERJET 5SI printer to produce high-quality printed documents and decrease network traffic while reducing trips to the office copier. The Mopy Upgrade Kit ($1279) includes a formatter board, which contains Hewlett-Packard's Transmit Once technology, as well as HP DocWise and Toolbox software; a 420-MB hard drive; a paper-handling controller board, which lets the LaserJet 5Si support the optional HP multibin mailbox and mailbox with stapler accessories; a CD-ROM with printer drivers; and HP JetAdmin software enhancements.
Contact: Hewlett-Packard Co., Santa Clara, CA, (800) 752-0900; http://www.hp.com.
Circle 1002 on Inquiry Card.

24-inch Color Monitor

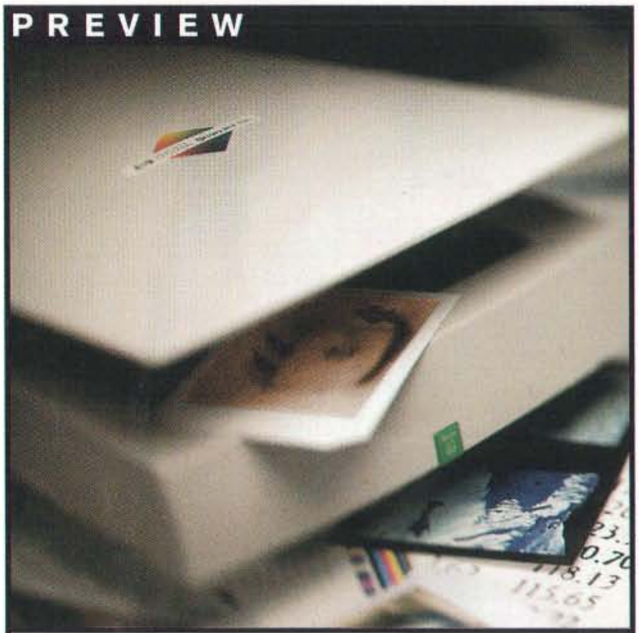
WITH A VIEWABLE IMAGE SIZE OF 22.5 inches, a usable screen area of 18.7 inches wide by 11.7 inches high, and a maximum resolution of 1920 by 1200 pixels, the GDM-W900 (about $4999) lets you view two full-size 8.5- by 11-inch or two A4 pages side by side. Based on a Trinitron tube with a variable 0.25- to 0.28-mm aperture grille pitch, the GDM-W900 incorporates Sony's Advanced Digital Multiscan +Plus technology delivering images with automatic distortion correction across a continuous range of scanning frequencies.
Contact: Sony Electronics, Inc., San Jose, CA, (800) 352-7669 or (408) 955-4334; http://www.sony.com/technology.
Circle 1012 on Inquiry Card.

D- and E-Size Wide-Format Plotters

THE LATEST SUMMACAD PLOTTERS (D-SIZE, $2495; E-size, $2995) can plot monochrome images at a resolution of 720 by 720 dpi and color drawings at a resolution of 360 by 360 dpi on cut-sheet media ranging in width from 8.5 to 36 inches and roll-feed media with a maximum plot length of 59 feet. The plotters come with 4 MB of memory, upgradable to 36 MB, and provide four monochrome plot modes—draft, normal, enhanced,

PHOTOGRAPH: BRIAN WILDER © 1997

PREVIEW



Hewlett-Packard ScanJet 5p
$399; Mac version, $449

Circle 997 on Inquiry Card.

Hewlett-Packard Co.
Santa Clara, CA
(800) 722-6538
http://www.hp.com

Flatbed Scanner Offers Well-Rounded Package

Hewlett-Packard's ScanJet 5p adds improved image quality, a sleek new design, a wide range of software, and Plug and Play installation. The color flatbed scanner, which replaces the company's entry-level scanner, the 4p, should sell for about $399 ($449 for the Mac).

The 5p's Plug and Play support, along with a 40 percent smaller footprint than the 4p, and new installation software available on a single CD-ROM (instead of floppy disks) make it easy to get the 5p up and running. Another nice touch: Recessed SCSI and power-cable connections let you place the scanner flat against a wall.

The image quality from the 5p was quite good in the beta unit I previewed, and photos looked fine when incorporated into Web graphics or as images in a newsletter. The 300-dpi optical scanner (24-bit) has an interpolated resolution of up to 1200 dpi and accepts documents as large as 8.5 x 11.7 inches.

Competitors such as Umax and Microtek offer higher optical-resolution scanners for about the same price, but the higher image quality is more of a plus for graphic arts than typical home and business users. The real appeal of the 5p is the overall package's design and integration, ease of use, and included software. **–Jon Pepper**

COMPFAIR 97

10. International Computer and Telecommunication Exhibition and Fair

14 - 18 October, 1997
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Information, application:

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H-1053 Budapest, Kálvin tér 5.
Tel.: (361) 117-1933, (361) 117-6760 Fax: (361) 117-0436

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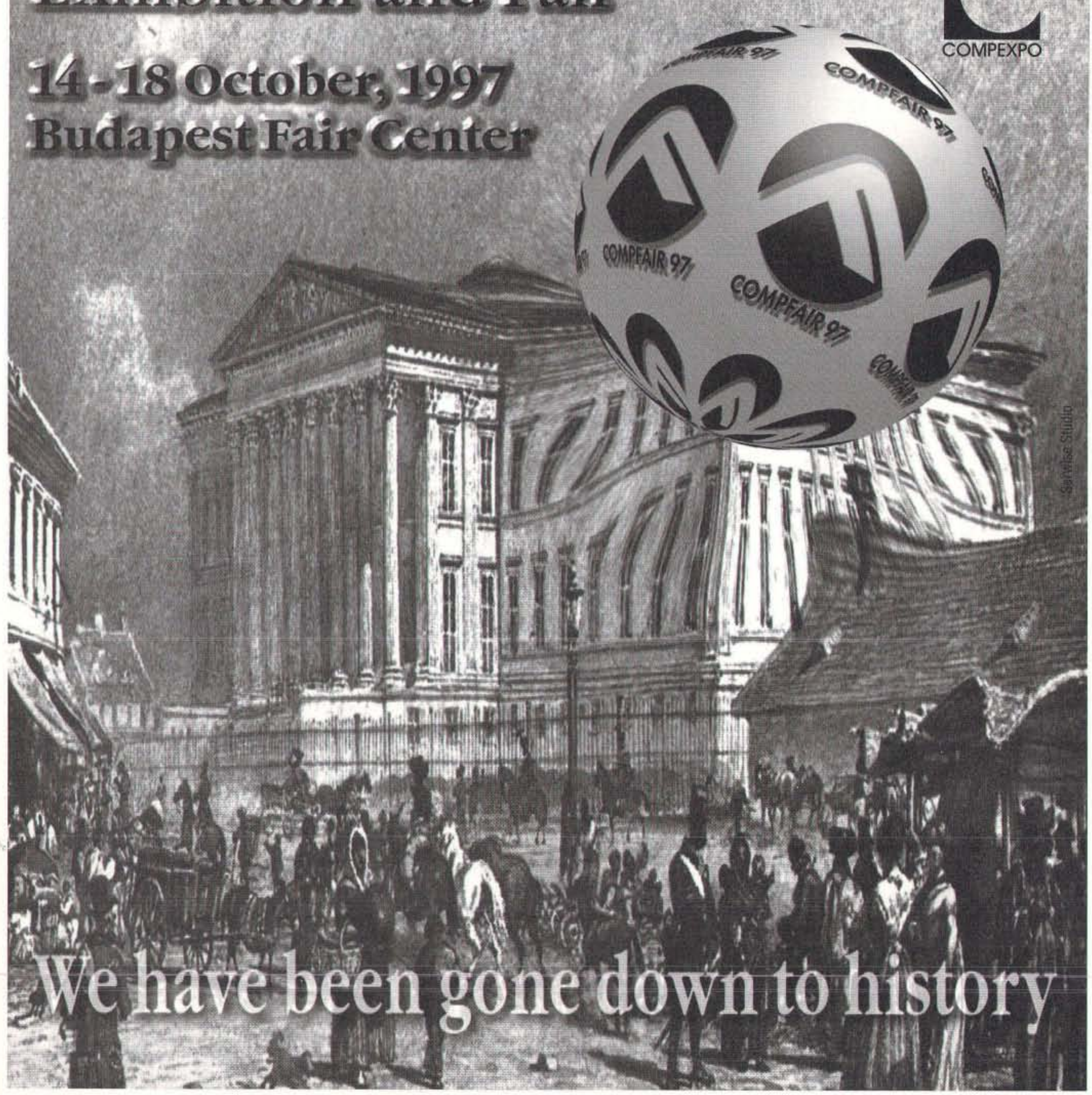
COMPEXPO



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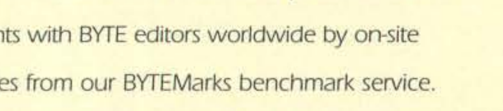

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and high-resolution. An optional external Ethernet interface supports TCP/IP, Novell NetWare, and EtherTalk.

Contact: CalComp, Anaheim, CA, (800) 444-3425 or (714) 821-2000; http://www.summagraphics.com.

Circle 1004 on Inquiry Card.

Variable Dot-Transfer Color Printer

The Spectra*Star T8050 ($11,500) produces photo-realistic, full-bleed tabloid-size (12.16 by 17.5 inches) documents. The printer's variable dot process produces sharply defined text and graphics and halftone dots, which results in more accurate proofs. The Spectra*Star T8050 can also produce double truck ads with full bleeds and crop and registration marks for prepress proofing.

Contact: Tally Printer Corp., Kent, WA, (206) 251-5500; http://www.tally.com.

Circle 1005 on Inquiry Card.

SVGA LCD Projector

A high-contrast 800- by 600-pixel LCD projector, the Impression 880 ($7495) can project computer-based images or presentations even in brightly lit rooms. Weighing in at 19 pounds, the projector features an interface for NTSC, SECAM, and PAL video systems; support for resolutions of from 640 by 480 pixels up to the Power Mac's standard of 1152 by 870 pixels; and the BatMouse, an infrared remote mouse that allows you to move freely around the room while controlling the presentation.

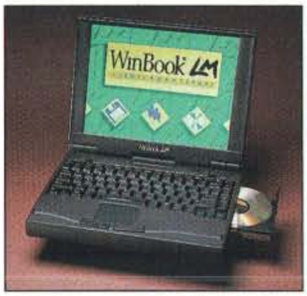
Contact: Ask LCD, Inc., Lyndhurst, NJ, (800) 275-5231 or (201) 896-8888; http://www.ask.no.

Circle 1007 on Inquiry Card.

Systems

128-bit Graphics Notebooks

The WinBook LM notebooks (P133, $3399; P150, $3799) are the first WinBooks with a 64-bit video accelerator and 128-bit graphics. The notebooks come with a 133- or 150-MHz Pentium processor, 16 MB of EDO RAM (expandable to 40 MB), 256 KB of synchronous burst cache memory, a PCI-bus architecture, a 1-GB hard drive, a 12.1-inch SVGA active-matrix color display, and a six-speed CD-ROM drive. Other features include 16-bit stereo high-fidelity audio support, Sound Blaster Pro compatibility, stereo speakers, a two-way infrared Data IrDA 1–compliant port, a docking connector, a microphone, and a PC Card slot that accommodates one Type III or two Type II cards. Power is provided by a nine-cell lithium-ion smart battery. You can also get an optional second lithium-ion battery, which fits in the options bay. The options bay will also accept a 3½-inch floppy drive or a six-speed CD-ROM drive.



Contact: WinBook Corp., Hilliard, OH, (800) 468-2162; http://www.winbookcorp.com.

Circle 1008 on Inquiry Card.

150-MHz Notebooks and Docking System

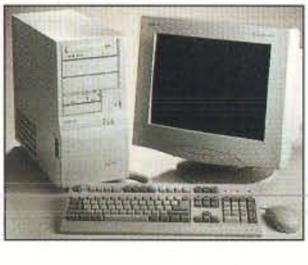
The Echos Pro notebooks (from $3499) feature 133- or 150-MHz Pentium processors, 16 MB of EDO memory (expandable to 128 MB), a 12.1-inch color TFT or DSTN display, a 1.3- or 2.1-GB hard drive, a Point Pad pointing device, and an internal 28.8-Kbps data/fax modem. Other features include 16-bit Sound Blaster Pro–compatible 3-D stereo sound, an infrared port, PC Card slots that accept one Type III or two Type II PC Cards, Card Bus support, Zoomed Video, and a multifunction bay that holds an eight-speed CD-ROM drive, a floppy drive, or an optional second hard drive. The Echos Pro Docking System ($999) includes two PCI card slots, two stereo speakers with a subwoofer, a multifunction bay, a 5¼-inch drive bay, and port replication.

Contact: Olivetti Personal Computers USA, Inc., Austin, TX, (888) 465-4838 or (512) 339-4383; http://www.olivettipc.com.

Circle 1009 on Inquiry Card.

Windows NT Graphics Workstation

Acer's minitower-configuration workstation, the AcerPower Windows NT Graphics Workstation (from $7500), comes with a 180- or 200-MHz Pentium Pro CPU, 64 MB of EDO RAM (expandable to 384 MB), a 4.3-GB Ultra Wide SCSI hard drive, an eight- or 12-speed IDE CD-ROM drive, and an Adaptec Ultra Wide SCSI adapter. You can choose a Diamond Multimedia Fire GL3000 graphics accelerator with a 3D Labs GLiNT 500TX rendering processor, 40 MB of memory (8 MB of video memory and 32 MB of DRAM), dual-monitor control, and hardware texture mapping; an S3 ViRGE/VX 3-D graphics accelerator with 4 MB of VRAM, expandable to 8 MB, and software MPEG support; or an S3 Trio 64V+ graphics accelerator with 2 MB of EDO DRAM and software MPEG support.



Contact: Acer America Corp., San Jose, CA, (800) 551-2237 or (408) 432-6200; http://www.acer.com/aac/.

Circle 1010 on Inquiry Card.

Portable Workstation

Built around twin 200-MHz Intel Pentium Pro CPUs, the Dual PAC-Pro (from $9295) comes with a 12.1-inch XGA flat-panel TFT display, five full-size PCI/ISA expansion slots, a patented card-retention plate, and high-throughput cooling integrated in the 20-pound portable package. Complementing the dual 200-MHz Pentium Pro CPUs is system memory ranging from 8 to 768 MB and 256 or 512 KB (L2) of secondary cache memory. Available peripherals include CD-ROM drives, optical read/write drives, high-speed tape backup and floppy drives, and telecommunications and network cards for server applications.

Contact: Dolch Computer Systems, Inc., Fremont, CA, (800) 995-7560 or (510) 661-2220; http://www.dolch.com.

Circle 1011 on Inquiry Card.

Javatalk

Convert Visual Basic to Java

Applet Designer turns Visual Basic programs into Java source code.

By Rick Grehan

I knew this would happen. I knew someone would try to find a way to turn Visual Basic applications into Java applications. Applet Designer from TVObjects is the first attempt at this I've seen. I suspect there'll be more.

Applet Designer actually lets you build Java applets from within the Visual Basic integrated development environment (IDE). The tool operates as a VB plug-in; when you fire up Visual Basic, Applet Designer's floating toolbar appears. With Applet Designer, you can use the Visual Basic IDE to construct a form and convert the visual content of that form into corresponding Java code. Applet Designer will also translate VB programs to Java programs.

Applet Designer translates at the source-code level; that is, Visual Basic source to Java source. There are caveats—lots, in fact—to the source-to-source translation route. The alternative path is to generate bytecode, which is the equivalent of machine-language code for the Java virtual machine (VM). Bytecode is portable, as it runs on any Java VM-enabled platform. Source code is also potentially portable, but you need to compile it with a Java compiler.

One caveat to the source-code approach involves type translation. Applet Designer can turn most, but not all, VB data types into corresponding Java data types. Applet Designer is unable to convert VB's object or variant data types. Ouch.

There's also the matter of exception handling, which in VB appears as `ON ERROR GOTO` statements, while Java uses the `try...catch` block. Ain't no way you're going to get a smooth translation there. Big ouch. I discussed this with the people at TVObjects, and they suggested ways of moving the error-handling code into a function/subroutine, then inserting the corresponding method in a `try...catch` clause. Some jobs require a crowbar, I suppose.

Other snares exist. Applet Designer can't handle implicit variables. There are restrictions on the `Select...Case` control structure. And Applet Designer can't swallow `EXIT` instructions. That last one really hurts.

But it would be incorrect to characterize Applet Designer as nothing more than a source-code translator. As I said at the outset, Applet Designer can also convert the visual content of a form into corresponding Java code. If you turn it loose on a VB form, Applet Designer will snoop out the buttons, checkboxes, textboxes, and other elements that populate the form. It then builds Java source code containing the equivalent objects. Applet Designer will even build event-handling code and correctly wire in the created objects. The version of Applet Designer I tested (version 1.0) recognized about 10 of the standard VB controls.

WHERE TO FIND

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There are advantages to the source-translation route. Because Applet Designer emits Java source, rather than bytecode, the level of reuseability of generated code is higher. For example, you can use the source to document the code's interfaces. This documentation could be useful to you (especially if you have a poor memory) as well as to other Java programmers.

Happily, version 1.0 is the first in what TVObjects hopes will be a series of ever-improving editions. Some of the shortcomings should be addressed in a new release that was slated for mid-January availability. The new 1.1 release will expand the number of VB elements it can translate. For example, Applet Designer 1.1 will properly handle the `EXIT` statement, recognize horizontal and vertical scroll bars, translate `Do...Loop` statements, and provide full-featured `MsgBox` and `InputBox` functions.

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As I write this, two editions are available: standard ($147) and professional ($497). The professional edition includes all the features I mentioned above, plus support for Java database connectivity (JDBC). The enterprise edition (just entering beta at press time) will add the ability to convert distributed VB applications into equivalent distributed Java applications using either Java remote method invocation (RMI) or Java objects that are compliant with the Common Object Request Broker Architecture (CORBA). If TVObjects can do all that, you may be reading about the company again in this column real soon. ■

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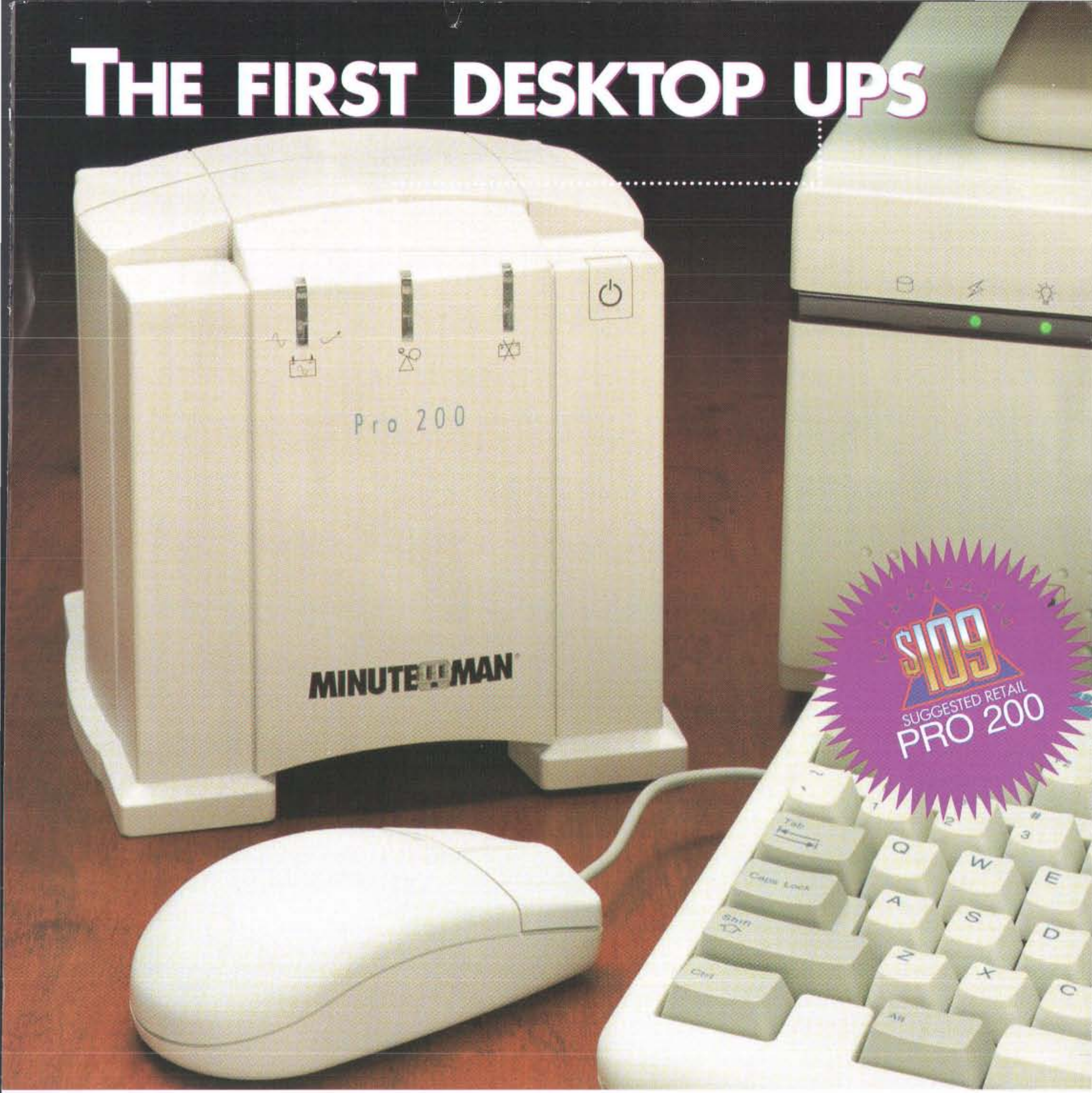

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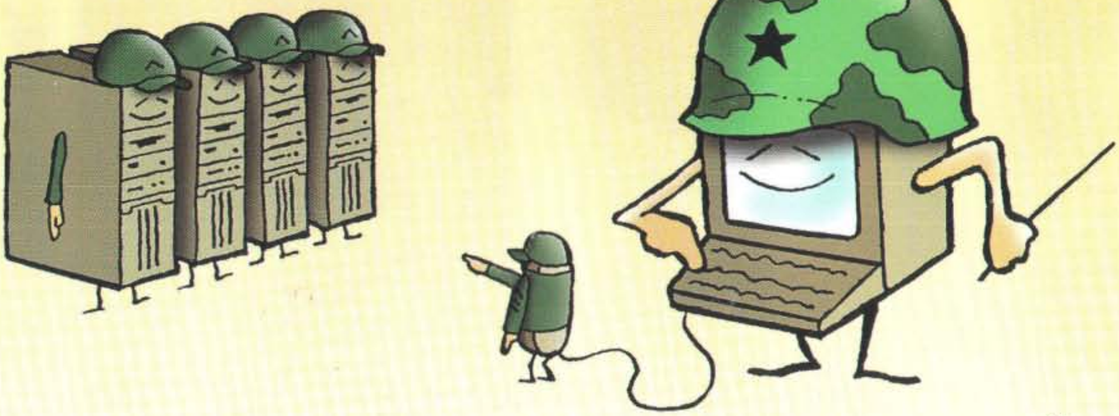

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